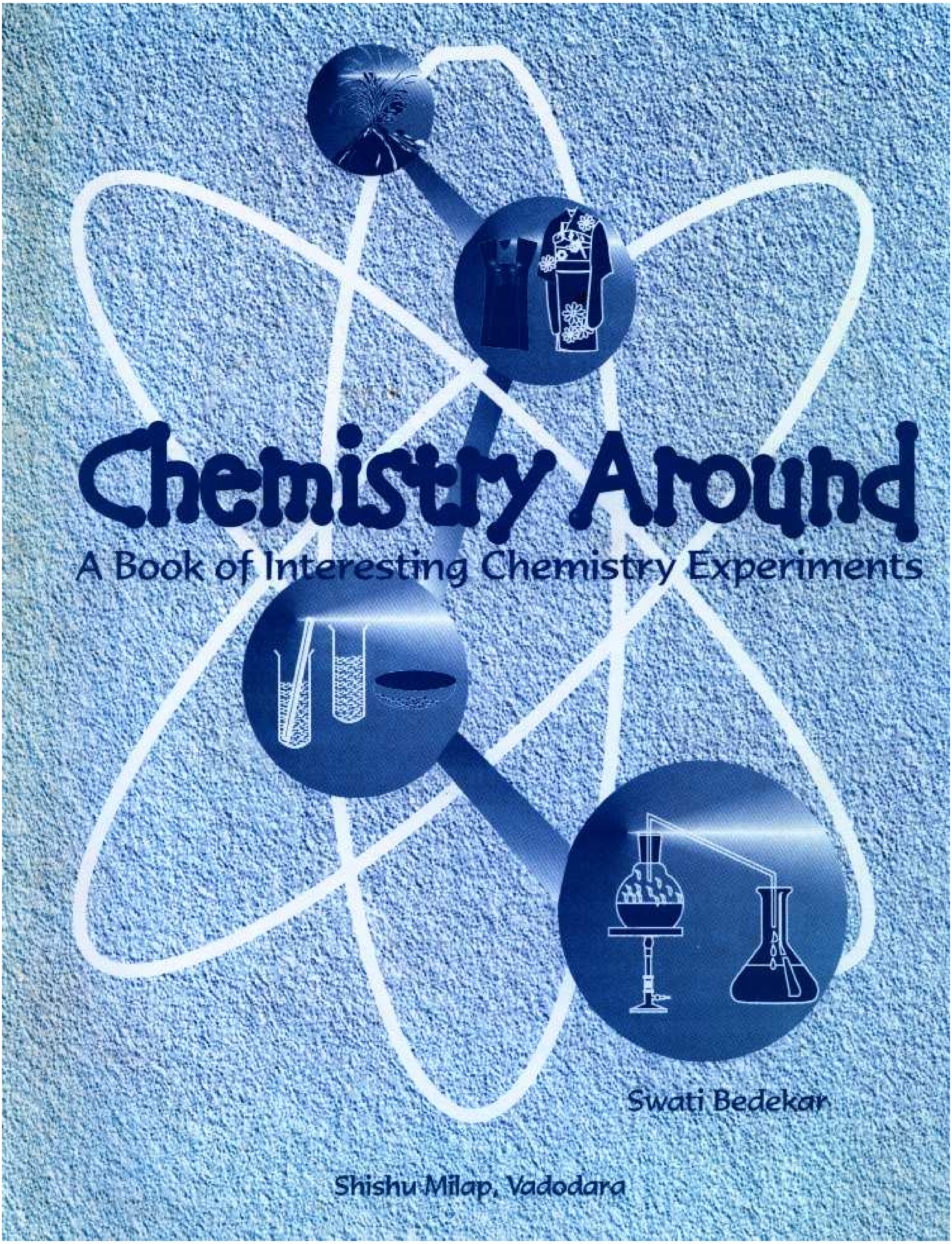


Chemistry Around

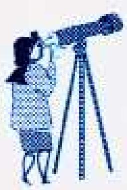
A Book of Interesting Chemistry Experiments

Swati Bedekar

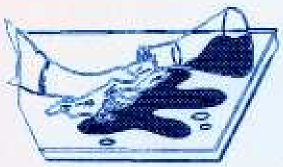
Shishu Milap, Vadodara

How Chemists Work...

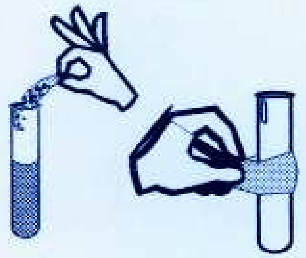
Curiosity



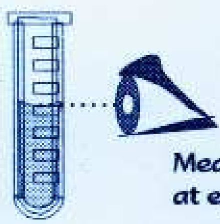
Knowledge and Skill



Wear gloves and wipe the spilled liquids with cloth



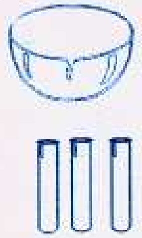
Use paper spoons and holders

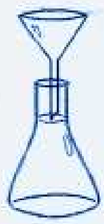


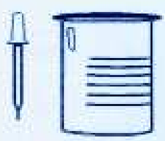
Measure liquid at eye level

Adequate Time

Proper Equipment







Patience

Chemistry Around...

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Swati Bedekar

Illustrations by SM Graphics

Shishu Milap

Vadodara-390007

Chemistry Around...

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Preface

Dear Friends,

Do you know the origin of the word 'chemistry'? It may have been derived from the word 'alchemy', an Egyptian/Arabic word meaning to do with 'black earth' ('Algebra' is also a word of Arabic origin). One of the many things alchemists tried to do was experiment with a lot of, well, chemicals and other stuff, either to obtain gold from other metals, or potions to get immortal. They did not really obtain gold, nor, as far as we know, immortality, but that could have led to developments ending in what we call modern chemistry.

But my little friends tell me that this is a subject they fear. Fear of earthly phenomena, deadly chemicals, complex chemical reactions, etc.

One way to get rid of fear of something is to get familiar with it. So try performing these simple experiments. It may help you get familiar. Experience the different phenomena. Understand the chemical reactions behind these phenomena and may be you will even start liking the subject. These experiments may help you clear concepts of chemistry. But more importantly it may create in you love (wow!) for the subject. Each section will provide you good science project ideas for school assignments. The experiments have been designed in such a manner that they can be carried out with easily available material. Or material that is available from a local lab chemicals shop. Still it is good to follow the discipline of a laboratory while performing these experiments so as to avoid accidents and learn good laboratory conduct.

Who knows you may end up by becoming a great scientist inventing useful things for people!
Do write back with your feedback and difficulties. That way we both can improve this book.

I sincerely thank Shishu Milap for providing this platform for a dialogue and especially the the AVISHIKA team for supporting me throughout this journey.
Happy experimenting!

Swati Bedekar
January 2003, Vadodara
Email: svb@wilnetonline.net

Perform experiments with this symbol in the presence of an adult.

Contents

EARTH AND ECOLOGY

For a long time changes have been taking place on our earth. Rocks are being formed and broken into soil. Continents are drifting apart. Seasons change. Sometimes the whether is rough, sometimes, sunny and warm. The motion of the sea, changing fertility of the soil, jungles, mountains, rains and many more, we are surrounded by these amazing things. Let us try and simplify these phenomenans and see them happening in our bottles and jars in which we shall perform experiments. After we understand a few secrets of the earth, we shall think more on how to take care our environment and mother nature.

CHEMICAL PROCESSES AND REACTIONS

When two or more substances react together to form a new substance (or substances) with new properties, a chemical reaction is said to have taken place. Most chemical reactions are irreversible. Another chemical reaction has to take place to obtain the original reactants in the reaction. Some reactions show various colour changes. We shall perform some chemical reactions to understand them. You will find even complex reactions very interesting once the basic processes are understood.

Contents

CHEMISTRY IN FOODS AND FANCIES

Food is delicious, food is energy, food is enjoyment! What is in the food that gives energy? What happens to the food once we have eaten it? Well, let us find out the delicious way.

There are various kinds of art forms. Does chemistry have any role to play in the works of art? The next series of experiments will provide an opportunity to create wonderful arty facts and understand the chemistry behind them. Very crafty!

USEFUL CHEMISTRY

Do we need to perform chemical reactions in day to day life? Are we eating chemicals? Are we all little chemists while we are doing our daily routine...

Human beings have recreated all their desires and fantasies about colours, textures and style in textiles. Let us learn about how to colour these natural or artificial fabrics.

Also, proper care of clothing keeps it in good condition. No person will ever look best in soiled or stained clothing. So let us learn something about grooming of the textiles. Stains are very difficult to remove. One should have the knowledge of textile fibers, fabric composition, dyestuff and chemicals used on different fibers. Spots should be removed immediately before washing or pressing a fabric. Pressing sometimes sets a stain. We need something more than just a detergent to remove stains. We shall perform some experiments to find out all about it.

Salt for Sea, Sweet for Earth...

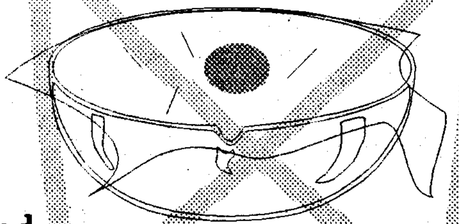
Earth and Ecology: For a long time changes have been taking place on our earth. Rocks are formed and broken into soil. Continents drift apart. Seasons change. Sometimes the weather is rough, sometimes, sunny and warm. The motion of the sea, changing fertility of the soil, jungles, mountains, rains and many more. We are surrounded by these amazing things. Let us try and simplify these phenomena and see them happening in bottles and jars. After we understand a few secrets of the earth, we shall think more on how to take care of our environment and mother nature.

You need: Ordinary salt, water, bowl, plastic sheet, stone, small cup.

What to do: Fill the bowl with water till half. Dissolve salt in the water till no more salt gets dissolved. This will make a saturated solution of salt. Place a small cup in the center of the bowl. Now cover the mouth of the bowl with transparent plastic sheet and fix it with rubber bands. Place the bowl in hot sun.

Place a stone in the middle of the plastic sheet. This will give the plastic cover a little depression. After two days open the plastic cover and observe.

What happens: The salt crystals are left behind in the bowl. The water is collected in the small cup inside. This water is no more salty to taste.



Chemistry Around...

The water evaporates by the heat of the sun, leaving behind salt crystals. This water reaches the cover and condenses. This condensed water travels from the depressed plastic sheet in the small cup placed inside. This is the process of solar distillation.

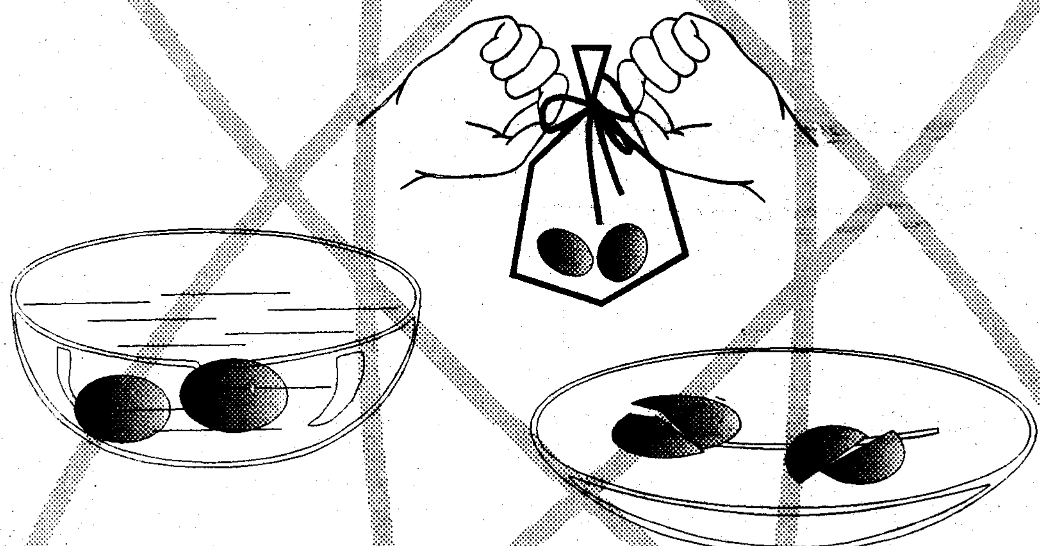
This is what happens when it rains. The water in the sea evaporates leaving the salt behind. This water condenses and forms clouds. As clouds come in contact with cold air they fall on the ground as rains. The rain water is pure and de-salinated (no salt present). Of course with pollution nowadays we have acid rain, rain water that is acidic.

Cracking of Mountain Stones...

You need: Sand stone from hardware shop, plastic bags, thread, water.

What to do: Place the pieces of sandstone in water overnight. Next day, place one piece of sandstone in a plastic bag and tie the mouth of the bag with a thread. Prepare three such bags. Place them in a freezer overnight. The next day examine all the stones.

What happens: The sandstones crack into smaller stones.



Chemistry Around...

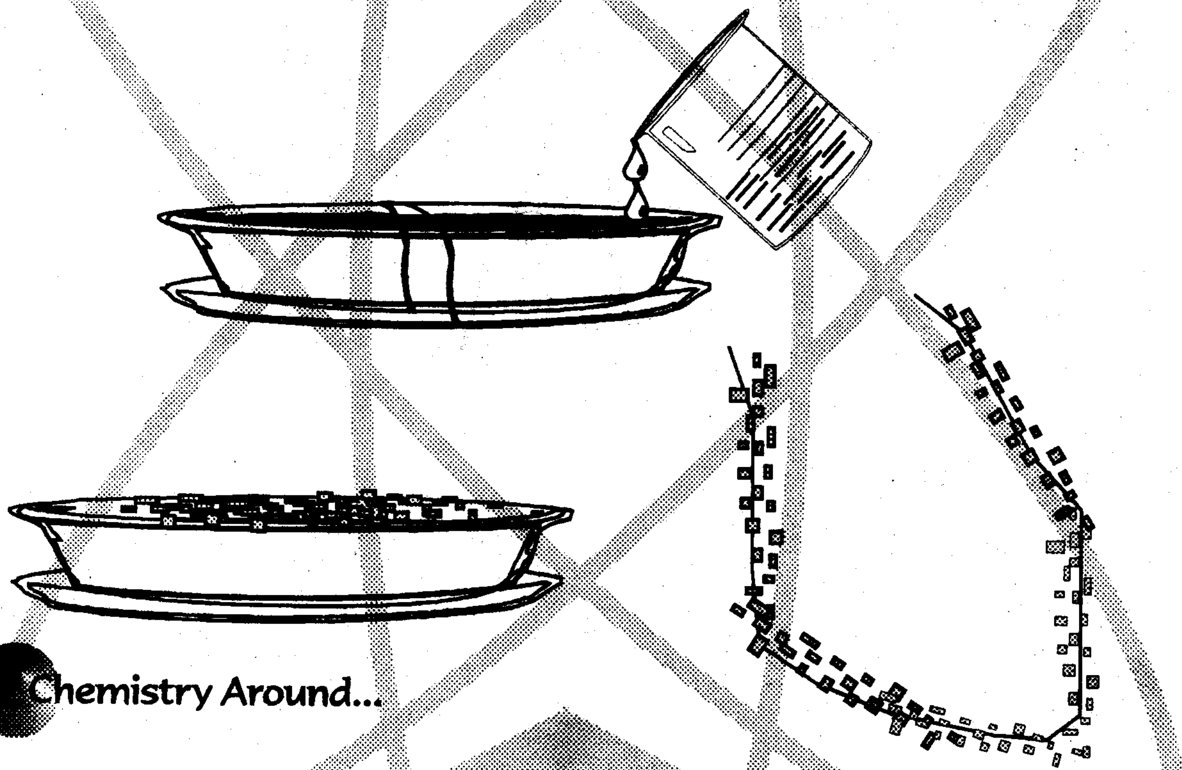
The sand stones absorb some water in the air spaces between the sand particles. When the stone is kept in the freezer, this water freezes and expands resulting in cracks in the stone. The same process happens in nature. Because of the cold weather, stream water freezes in the mountains and expands, resulting in cracks in the mountains.

Crystal Necklace...

You need: Clay pot, salt, water, copper wire, garden soil or mud.

What to do: Fill the soil in the pot till half. Place a loop of copper wire on the soil. Dissolve salt in water until no more salt can be dissolved. Pour this mixture over the soil and copper wire. Place the tray in the sunlight to dry.

What happens: As the soil dries you will see crystals formed along with the copper wire, forming tiny shining beads. Allow them to dry for some more time. You will have the entire copper wire covered with crystal beads.



Chemistry Around...

Salt crystallises near the copper wire. Crystals formed always remain 'hung' to an object. We used copper wire to get a string of crystals to make it look like a sparkling bead necklace.

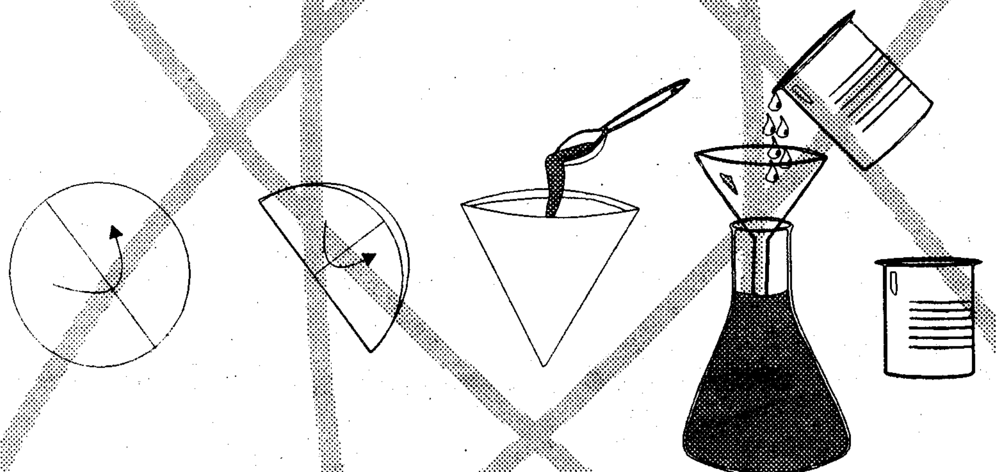
Also see the bushes of crystals formed on the mud. This is how rock salt is formed near salty cricks.

Washing off Nutrients with Leaching...

You need: A wide-mouthed glass jar, funnel, filter paper, spoon, small cup, powdered colour, water.

What to do: Mix one teaspoon of powder colour with the soil evenly. Place the filter paper in the funnel and place the funnel in the glass jar. Pour the coloured soil in the funnel. Now pour a cupful of water over the soil slowly. Observe the colour of the water collected in the jar. Remove this water and pour another cup in the funnel. Observe the colour of the water again. Repeat this at least two more times.

What happens: The colour of the water collected in the jar for the first time is very dark. The second and third time it gets lighter and finally clear water passes through.



Chemistry Around...

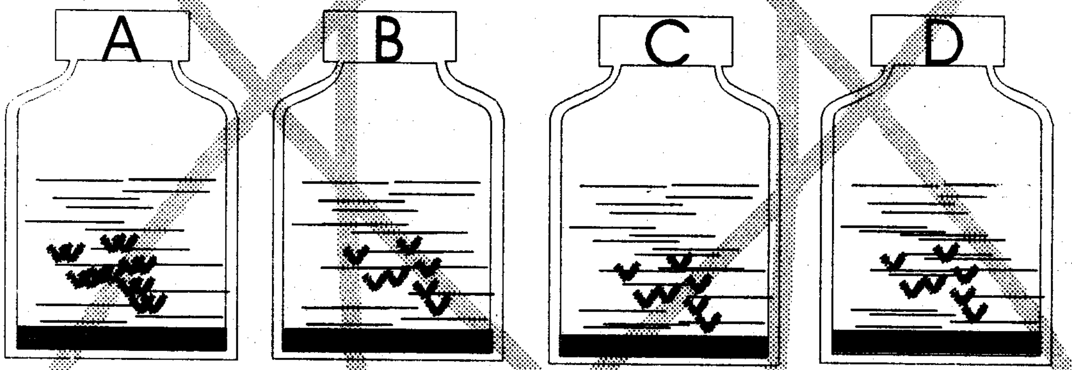
The light colour particles mix with water and run through the solution. The quantity of the colour in soil reduces with every rinse, so that the colour of the water is lightened. This experiment is analogy of the nutrient erosion on mountains. Nutrients in the soil can get washed off like the colour every time it is leached off by the rains or rivers.

Pollution Covered Plants...

You need: Four glass jars, algae or scum, vinegar, engine oil, detergent, fertilizer, water

What to do: Place some soil and small pinch of fertilizer in each jar. Fill the jars till one third with plain water. Now add some algae or pond water with scum. Add more water if required. Make sure that the jars are filled to two third capacity. Label them as A, B, C, D. Now add a pinch of detergent to A and a few drops of engine oil to B. And add 3 to 4 drops of vinegar to C.

What happens: Jar A, Jar B, and Jar C show how pollutants stop the growth of the plants. Algae in Jar D shows proper growth.



Chemistry Around...

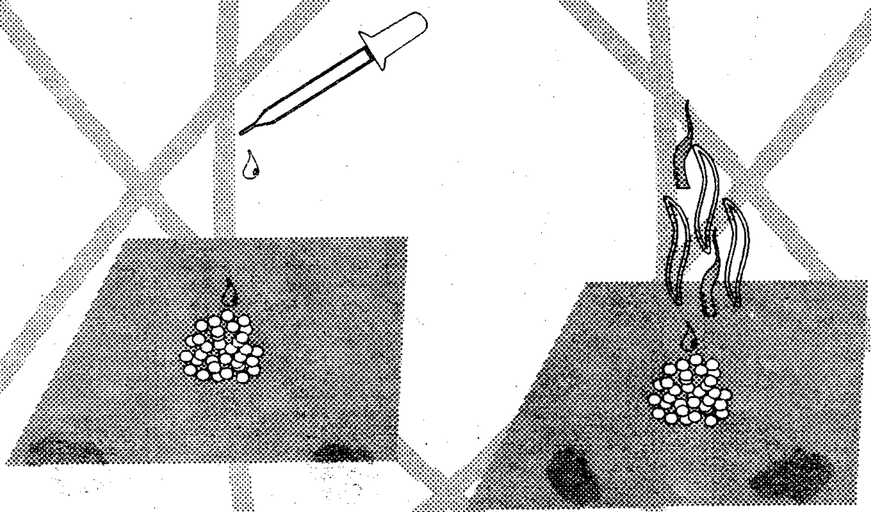
The spills of detergent, oil and vinegar changes the healthy habitat of the plants and affects their growth. Jar D still has the same environment so the plants grow in the same way as before in it. Oil spills on water stops the atmospheric oxygen from dissolving in the water. Thus plants do not get fresh supply of oxygen. The detergents prevent supply of oxygen.

Volcano, Ash Mountain...

You need: Aluminum powder, iodine crystals, water.

What to do: Mix half a spoon of aluminum powder and half a spoon of iodine crystals and place on a flat dry stone. Make a heap of the powders to make it look like a hill. Add two drops of water over this mixture with the help of a dropper. Observe.

What happens: After a few seconds, red coloured fumes of iodine come out of the mixture and grayish black aluminum Iodide is formed.



Chemistry Around...

The water drops added provided a medium for the reaction to take place. Water drops act like a catalyst helping the reaction to take place faster. A catalyst is a substance that helps the reaction to take place much quicker.

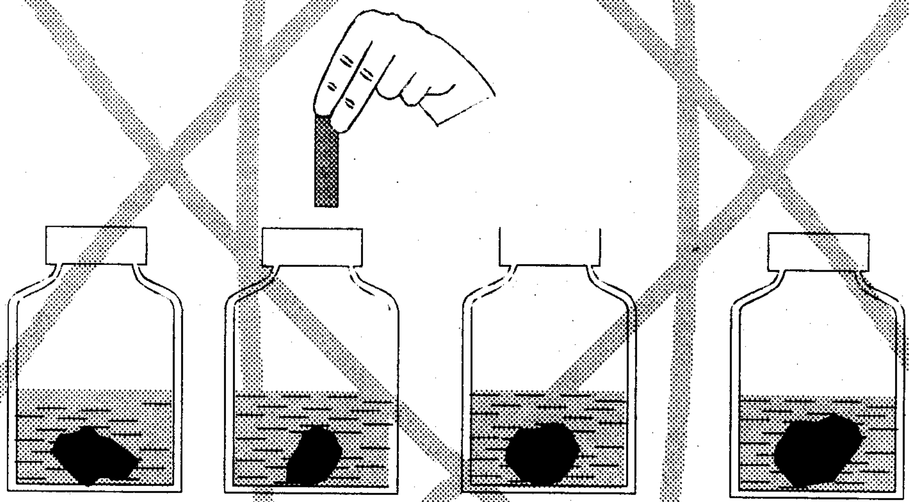
Arrange this heap aluminum powder and iodine on a dry surface.

Soil Testing for pH Value...

You need: Soil samples from various places, jars, distilled water, pH papers.

What to do: Clean all the jars thoroughly. Collect soil samples in separate jars and label them. Mix them with distilled water. Distilled water has pH 7. It is neutral. Dip the pH paper in each of the samples. The pH papers will show some colour change. Quickly compare the colour with the pH colour chart and note down the observations.

What happens: The pH readings of the various soil samples are different.



Chemistry Around...

The pH paper tells us the pH of the soiled water. If the pH reading is below 7, the soil sample is acidic. The soil sample is neutral if the pH is 7. Higher pH indicates alkaline soil.

Desired pH range of the soil for better growth of some plants are:

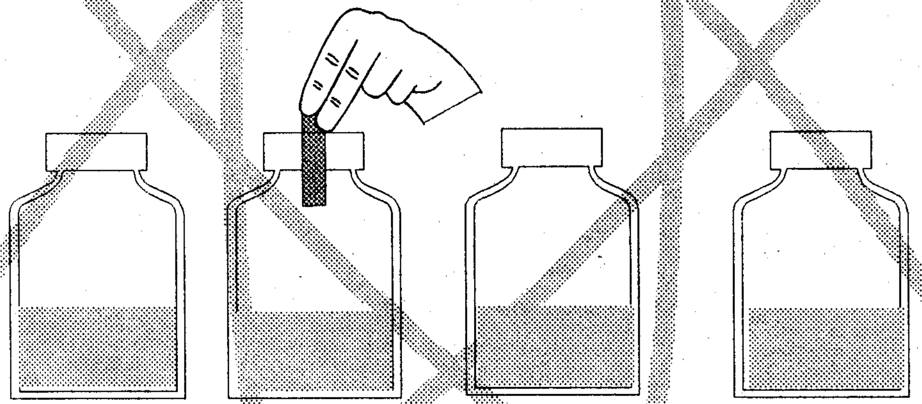
Onions	6.5 to 7.5	Potatoes	5.5 to 6.5
Tomatoes	5.5 to 7.0	Carrots	6.5 to 7.5

Testing Water Samples for pH...

You need: Water samples from rain water, pond, well, river, tap, etc., small glass jars, pH papers.

What to do: Clean all the jars thoroughly. Collect water samples in separate jars and label them. Dip pH paper in each of the samples. The pH papers will show some colour change. Quickly compare the colour with the colour chart and note down the observations.

What happens: The pH readings of the various water samples are different. The pH of the water tells us the strength of hydrogen ions present in the water. If the strength of hydrogen ions in a solution is equal to 7, then the solution is considered to be neutral. Lower pH (lower than 7) tells us the solution is acidic and pH more than 7 indicates the solution is basic or alkaline.



Chemistry Around...

The pH value of a solution tells us the acidic or alkaline nature of the solution. The pH paper tell us the pH value of the water. If the pH reading is below 7, the water sample is acidic. The water sample is neutral if the pH is 7. Higher pH indicates the nature of water as alkaline. If the atmosphere contains industrial gases, they can turn the rain water acidic. Such acid rain can fall on the soil turning it acidic.

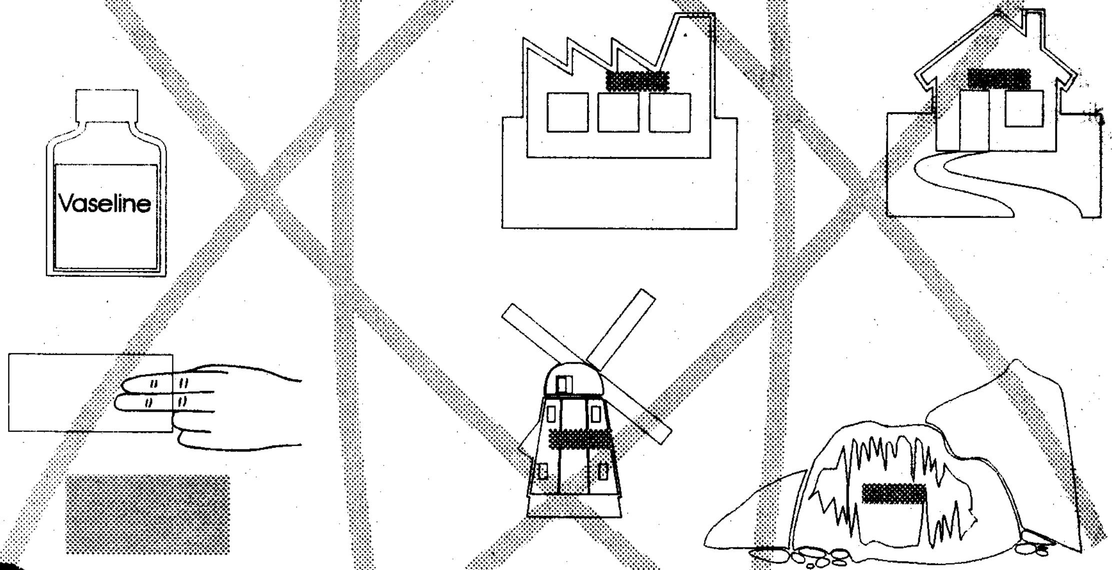
A pH paper can be prepared by dipping the filter paper strips in the universal indicator.

Measure the Dust in the Air...

You need: Cardboard, White paper, vaseline, cellotape

What to do: Cut the strips of the white paper and stick them at the bottom of the cardboard piece. Rub some vaseline on the cardboard pieces. Stick the four cardboard pieces at different places. One outside on the wall near the road, one on the inside wall of a factory (or your kitchen), one on the window pane inside the drawing room.

What happens: After several days, the cards placed outside the house start accumulating a good amount of dust and other pollutants. The cards indoors accumulate comparatively less dust and pollutants.



Chemistry Around...

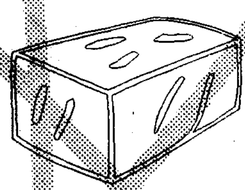
The dust and the pollutants settle on the ground, on the buildings and so they do on the cards. The accumulation of these particles will tell us how much pollution is there in the air around us. Similarly it will tell us comparative study of degree of pollution near the factory, roads and inside and outside of our homes. This dust can be collected and weighed with a scientific analytical balance to quantify the pollution llevel.

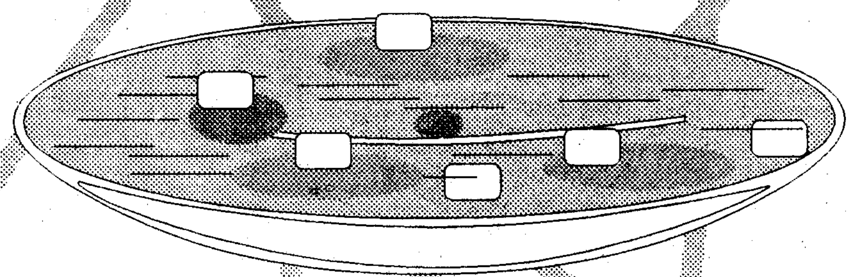
Cleaning Oil Layers...

You need: A shallow plate, water, machine oil, bubble gum, toothpick, paper.

What to do: Fill the plate to half the level with water. Carefully float a few drops of machine oil in the center of the plate. Now grate the bubble gum on a paper or make it into tiny pieces. Drop some pieces of bubble gum on the oil. Let some pieces fall in water. Leave them for half an hour.

What happens: The gum absorbs the oil in the water. If the gum pieces are more in number then they will absorb most of the oil. The pieces that were in the water remain unaffected.





Chemistry Around...

The chewing gum has hydrophobic - water repelling nature - that is, it does not attract water molecules towards it. But it can absorb oil.

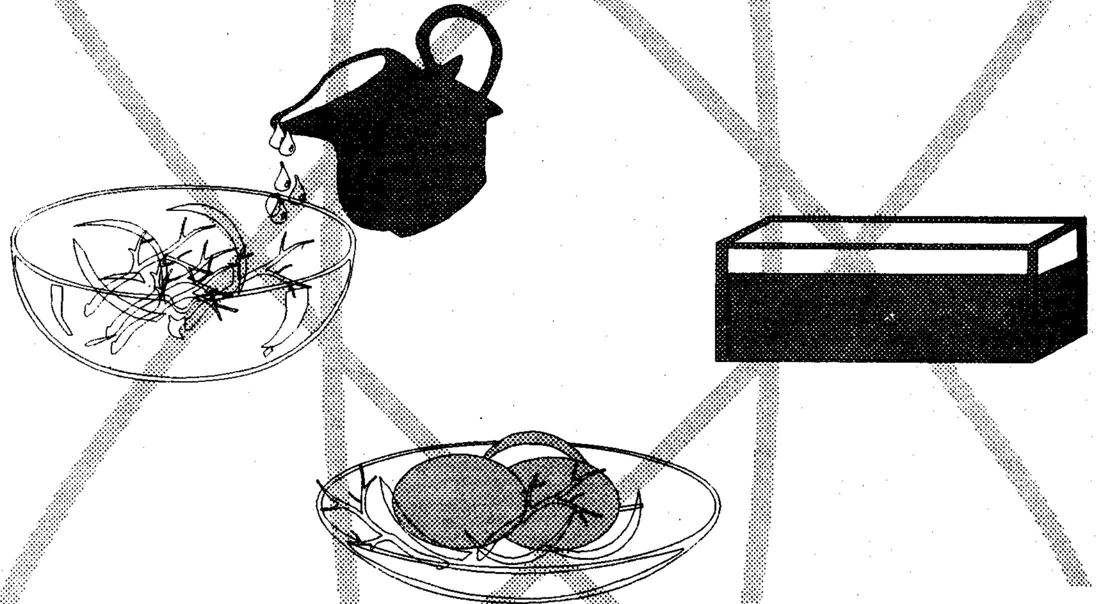
That is why the gum pieces in the water do not absorb any water. Thus gum absorbs the oil floating on the water.

Brick-Building...

You need: Ordinary or garden clay, water, dry hay, old shoe boxes or match boxes

What to do: Mix some clay and pieces of dry hay or straws in a bucket. Add water to this mixture and make a soft dough. Place this dough in the shoe box. Allow it to set in a warm place overnight. Take it out slowly the next day and place it for drying in the sun for some days.

What happens: A homemade brick will be formed. It will have some strength as it dries, but not enough strength as it is not baked in a furnace.



Chemistry Around...

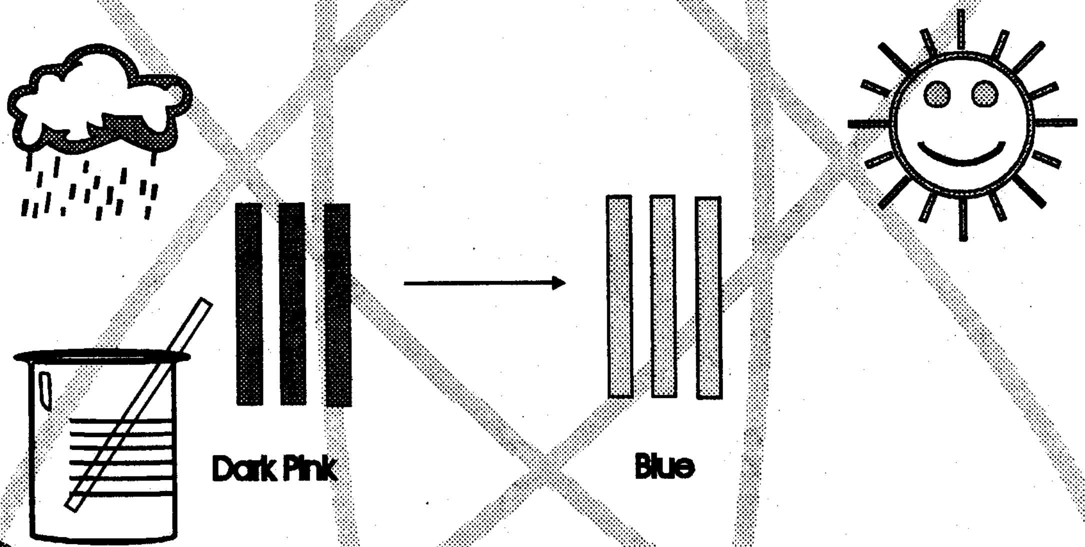
The soil particles develop strength to hold on to each other as they get dehydrated very high temperature provided to a small area. Whenever the soil faces exposure to high temperature, it has to be tilled to be soft again. To make a solid brick it is baked in the oven at around 800 to 1200 degree centigrade.

Water in the Atmosphere...

You need: Cobalt Chloride ($CoCl_2$), water, paper strips.

What to do: Dissolve cobalt chloride in water. The solution is dark pink in colour. Cut the paper in to one inch strips. Dip these paper strips in the solution of cobalt chloride. Dry them in the sun. The paper strips will turn light blue in colour. These strips can be mounted on a cardboard and placed in the room.

What happens: As the humidity (water vapor level in the air) in the atmosphere increases, cobalt chloride strips turn pink. You can see this colour change clearly during monsoon when humidity increases considerably.



Chemistry Around...

Some salts posses water of crystallisation. They exist in particular colour in presence of water. Cobalt chloride ($CoCl_2$) is blue in colour under total dry conditions. It turns pink on absorption of water.

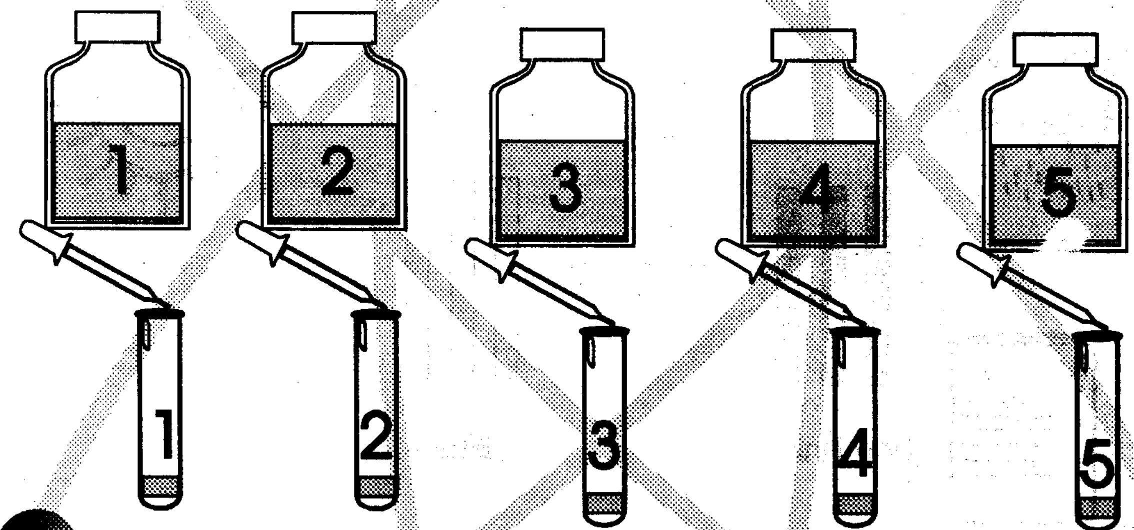
You can try holding blue cobalt chloride strips near water cooler. Water droplets that are thrown from water cooler will be immediately absorbed by cobalt chloride showing the colour change.

Is this Water Hard?...

You need: Five glass bottles, soap sample, water samples from different places such as tap, well, lake and distilled water, etc., five test tubes.

What to do: Wash glass bottles and number them from 1 to 5. Take half a teaspoon of soap sample in these five bottles. Add 20 ml of water from different samples of water to each bottle and stir to dissolve the soap. Now take five clean and dry test tubes. Number them from 1 to 5. Add five drops of the soap water(not detergent) solution to the corresponding test tube. Cover the test tube with thumb and shake vigorously five times. Foam will be formed in the remaining empty portion of the test tube. Repeat the experiment for the other four samples. Measure the height of the foam formed. Note down the observations.

What happens: Greater the height to which foam rises, softer is the water in the test tube.



Chemistry Around...

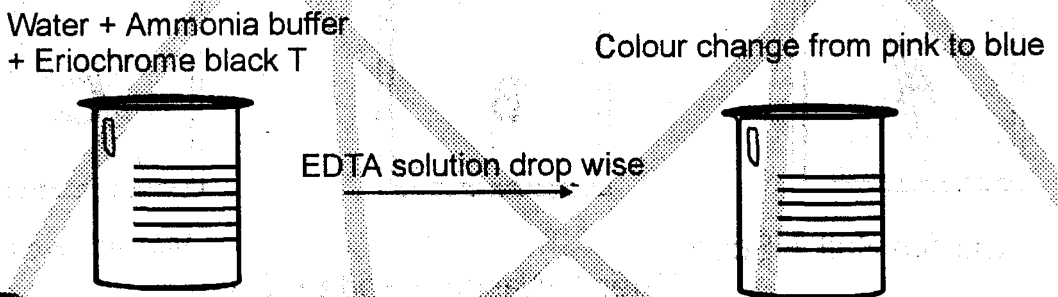
Water contains different mineral salts such as calcium or magnesium salts. The more the amount of these salts in the water, harder is the water sample. These mineral salts prevent soap from producing foam in the water. Hard water is not useful for washing clothes. Very hard water (hardness over 400 ppm of calcium carbonate) is also considered unfit for drinking..

Water Hardness Test...

What you need: Ethylene diamine terpthalic acid (EDTA) solution (10N), ammonia buffer solution, eriochrome black T indicator, dropper, beaker.

What to do: Take 25 ml of water sample in a beaker. Add 10 drops of ammonia buffer solution to it. This gives the water high alkaline pH. Now add 2-3 drops of eriochrome black T indicator to the solution. The solution will show pink colour. Add EDTA solution to this beaker drop wise. Shake the beaker gently after adding each drop. Continue to add drops of EDTA until the colour changes from pink to blue. Count the number of drops required to change the colour of the solution.

What happens: When ammonia buffer is added to the solution it increases the pH of the water sample. Eriochrome black T indicator shows colour change only at a high alkaline pH. EDTA solution forms a blue coloured complex with calcium and magnesium salts. The concentration of EDTA solution added is adjusted in such a way that one drop of EDTA is required to change colour of 1 part of calcium carbonate per million parts of total salt present in the water sample. So the total hardness of the water is calculated as: one drop of EDTA solution is equal to 1 ppm (parts per million) of calcium carbonate ($CaCO_3$). This is how water hardness is calculated in laboratories.



Chemistry Around...

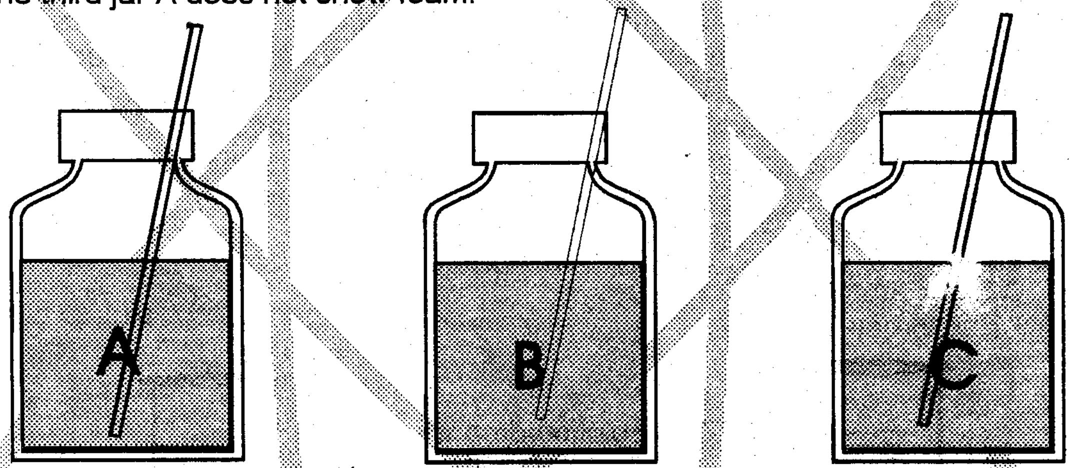
There are calcium and magnesium salts dissolved in water. These salts give hardness to the water. When water is extra hard, it does not give foam with soap. Sometimes such hard water can not be used in industries. Hardness of water is always measured in concentration of calcium carbonate which is present in water. Calcium and magnesium salts form a pink colour complex with eriochrome black T indicator. As EDTA solution is introduced, calcium and magnesium salts form a new blue colour complex as EDTA is attracted towards them. That is why we count drops of EDTA to understand how much EDTA is required by calcium and magnesium salts to form a blue complex.

Water Softener...

You need: Three jars, tap water, liquid soap, epsom salt ($CaSO_4$), washing soda (Na_2CO_3).

What to do: Fill the three jars with tap water. Add 1 spoonful of epsom salt in one jar. Label it as jar A. Add one spoonful washing soda in jar B. Let jar C contain plain tap water. Now add two spoons of soap solution (not detergent) to all the three jars. Shake the jars to make foam.

What happens: Jar B forms good foam. Jar C also forms foam but not as much as jar B. The third jar A does not show foam.



Water + Epsom Salt + Soap

Water + Washing Soda + Soap

Water + Soap

Chemistry Around...

Epsom Salt is a mineral salt which prevents the soap from foaming in the water. Many a times calcium salts are present in the water making it 'hard.'
Washing soda softens the water or neutralises calcium salts present in the water. Your tap water sample will form foam according to its hardness, that is, the amount of calcium or magnesium salts present in the water.

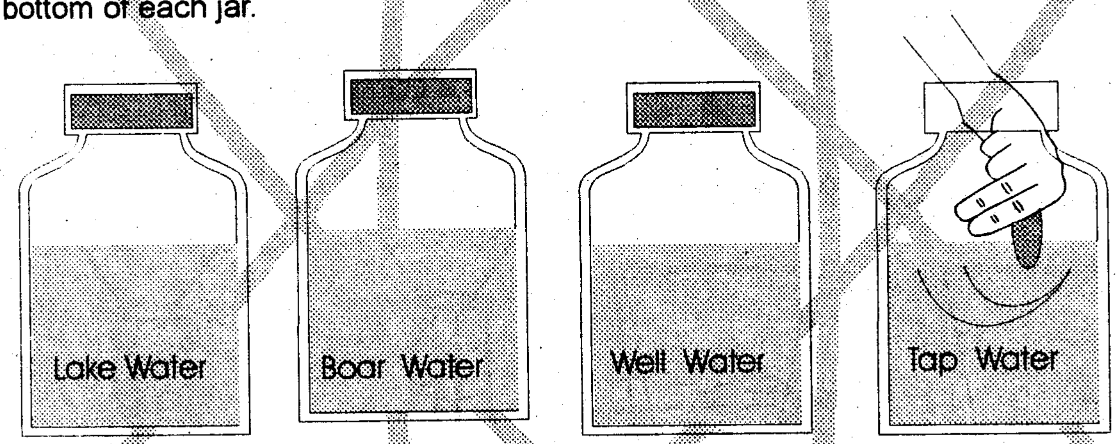
Water Cleaner...

You need: Water samples from well, tap, lake, and rain water, etc., alum (*phitkari*), big glass jars.

What to do: Collect water samples in big size glass jars. Label them as per their source. Observe which water sample *looks* cleanest. You will be able to see suspended soil particles in the water. Sometimes these soil particles float in water in such large quantity that they even make water look brownish in colour.

Take a piece of alum. Turn it two to three times in each water sample. Close the jars and leave them undisturbed for at least six hours.

What happens: After six hours, suspended soil particles will settle down at the bottom of each jar.



Chemistry Around...

Oil particles keep moving in random motion. The similar electrical charge on them stops them from coming together or coagulating. They remain suspended in water because of this motion. This turns the water muddy. Alum is a double salt which helps in nullifying the electrical charge on the soil particles and coagulates them. They become heavy and settle down.

Alum only cleans the water from suspended mud and does not purify it.

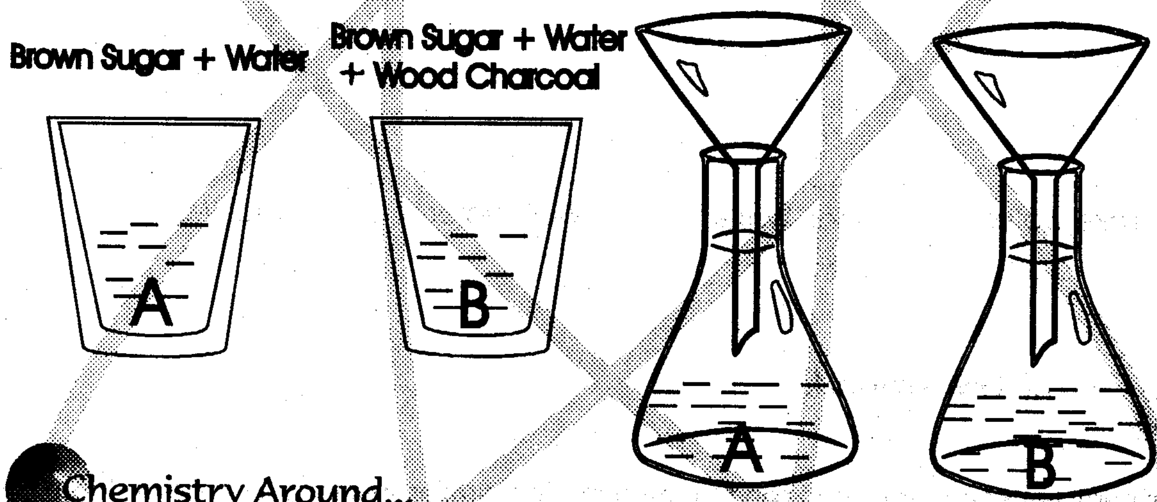
Charcoal Magic...

You need: Brown sugar cubes, warm water, beaker, filter paper, wood charcoal.

What to do: Take 100 ml of warm water in a beaker. Now dissolve brown sugar cubes in the water. Filter half of the water through filter paper and observe the colour of the water.

Now add wood charcoal to the rest of the water and stir well. Filter this water through filter paper. Observe the colour of the filtered water.

What happens: The sugar solution possesses some colour even after filtering the solution. The water in which charcoal is mixed, gives a colourless filtrate.



Chemistry Around...

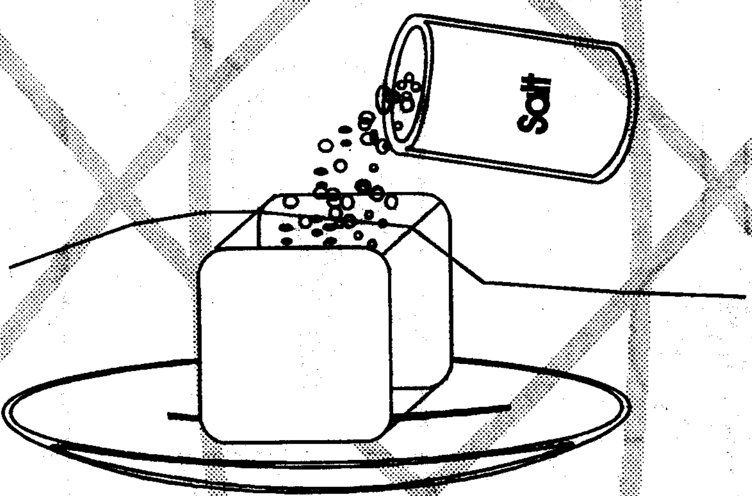
The charcoal removes the colouring matter (impurities) form the water.

String Power...

You need: Ice cube, salt (NaCl), string.

What you do: Place an ice cube in a dish. Place the string on the ice cube horizontally. Place a pinch of salt on the area where the string is kept. Wait for a while. Now try lifting the ice cube holding the two ends of the string. You may have to try more than once. But observe carefully -- the dissolved water will solidify again.

What happens: With little effort you will actually be able actually to lift the ice cube.



Chemistry Around...

The water dissolves from the ice cube when exposed to air. But as salt is placed on the ice there is shift (depression) in the freezing point (freezing point is lowered due to addition of electrolyte in water). The superficial melted water solidifies again because of lowering of the freezing point. The string gets caught between the newly formed layer of the ice. That is why you are able to lift the ice cube with the string.

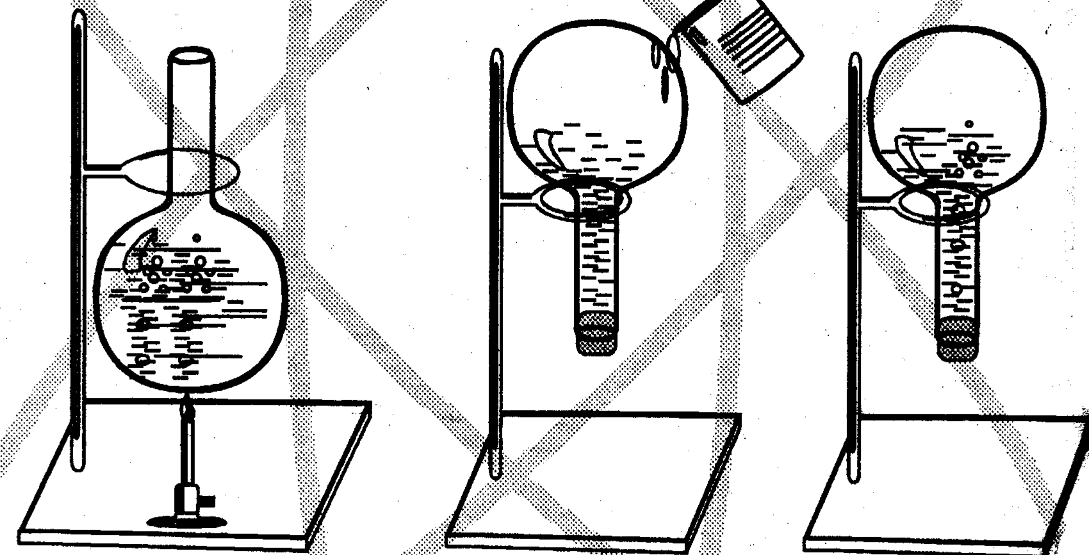
Boil Water with Water...

You need: Round bottomed flask with tight fitting cork, water, burner, clamp stand, tripod.

What to do: Fill up to half the round bottomed flask with water. Place it on a burner and boil the water. Let the water produce a lot of steam. Remove the burner. Tighten the cork of the round bottomed flask. When water stops boiling, hang the flask upside down. Let the surface of the water calm down.

Pour some cold water on the rounded surface of the round bottomed flask. Do this very carefully. Make sure the wall of the flask has cooled little bit as it may crack after adding cold water.

What happens: The water inside the flask will start to boil again without any external heat.



Chemistry Around...

When we sprinkle cold water on the surface of the round bottomed flask, the steam inside the flask is converted into water. This is the process of condensation. This leads to a decrease in the pressure inside the flask. The water starts boiling at this lower temperature even without heating it.

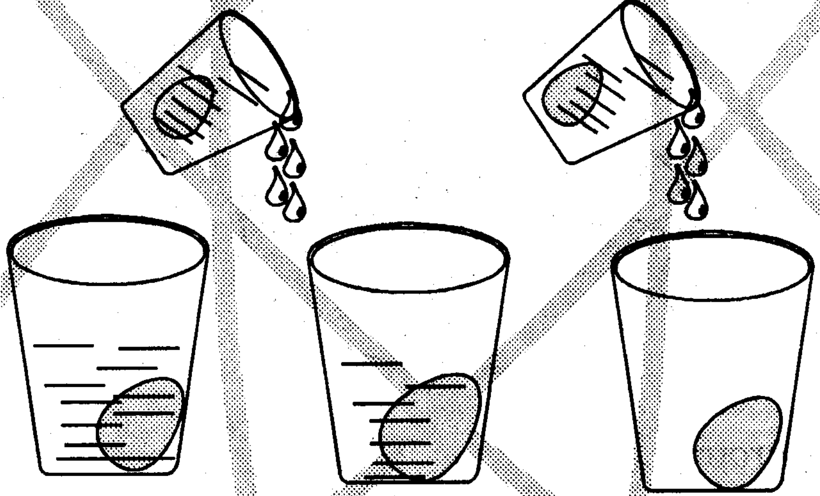
Water boils at lower temperature if the pressure is lowered.

Thirsty Egg...

You need: Glass, an egg, vinegar, water.

What to do: Fill the glass with vinegar to one third. Place the egg in the vinegar overnight. You will see bubbles appearing in the vinegar. After 24 hours, the entire egg shell would have dissolved in the vinegar. The egg does not fall apart as a thin albumin cover inside is still intact. Now carefully drain the vinegar. Add fresh water to the glass from the sides. Allow the egg to stand in water for two hours. Drain the water without disturbing the egg. Observe.

What happens: The egg shell gets dissolved in vinegar. This is the reaction between calcium carbonate and acid releasing bubbles of carbon-di-oxide gas. The egg 'drinks' up some amount of water and gets inflated. Once the water is drained it again shrinks after some time. If we put the egg once again in water, it will again grow in size by absorbing water.



Chemistry Around...

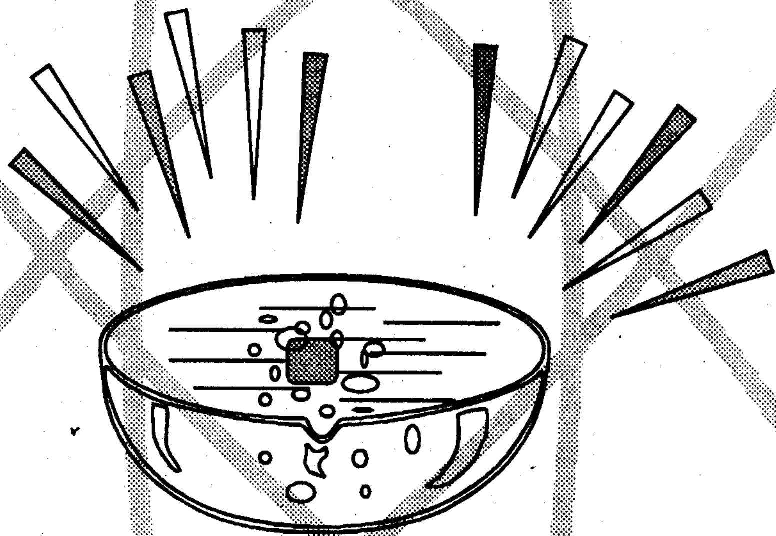
Inside the egg, the shell of albumin is strong enough to hold the egg together if you do not press it hard. That is why the egg does not lose shape or contents even after outer shell is gone. The action of 'drinking' of water by the thirsty egg is called osmosis. When the egg is removed from the water it loses the water that travels inside the albumin layer due to osmosis.

Metals and Water...

You need: Sodium (Na) metal pieces preserved under oil, water, wide-mouthed jar.

What to do: Remove sodium metal from oil, dry it by holding it in between two papers and place it in a jar filled with water. stand back.

What happens: A vigorous reaction takes place between metal and water. You can see a fire near the surface of the water with a loud popping sound.



Chemistry Around...

Water reacts with some metals to give out hydrogen gas. Sodium is a soft metal and reacts vigorously with water releasing hydrogen gas. A lot of heat is also given out in this reaction due to which hydrogen catches fire and burns with a 'pop' sound. Therefore we see a flame near the surface of the water.

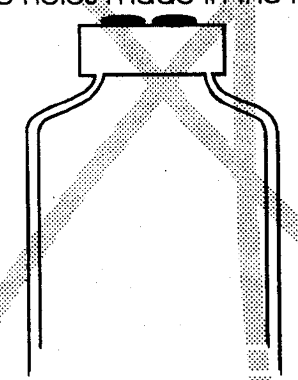
$$2Na + 2H_2O \longrightarrow 2NaOH + H_2$$

Sodium metal + Water → Sodium hydroxide + Hydrogen

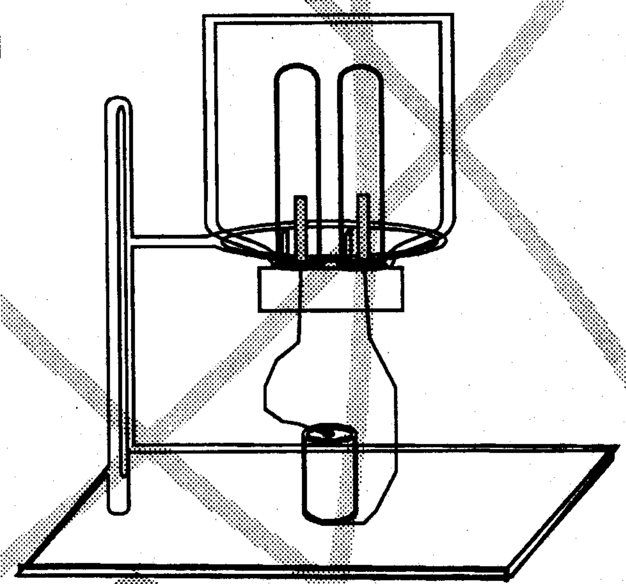
Electrolysis of Water...

You need: Wide-mouthed thick plastic jar whose bottom is cut off and two large holes made in the tight lid, stainless steel pen nibs, two corks with holes which fit in the holes of the jar as well as test tubes, sodium hydroxide (NaOH), water, 6 volt battery, two test tubes, copper wires.
What to do: Attach one end of the wires to the pen nibs and insert them in the hole of the cork. Fit the corks in the holes of the jar. Now fill the jar to half with water. Add five drops of sodium hydroxide (NaOH) solution to it. Invert two test tubes filled with water over the pen nibs. Connect the other ends of the wires to the 6 volt battery. Weight for some time.
What happens: You will see bubbles of gas being formed at the pen nib electrodes. After some time (may be 10 minutes) you will see the upper parts of the test tubes are filled with gas. Do you find any difference in the levels of the gas collected in two test tubes?

Two holes made in the lid



Bottom is cut open



Chemistry Around...

If we test the two gases with a burning splinter, one of the gases burns with a popping sound. This is the test for hydrogen gas. The other gas will help the splinter burn brightly. This is the test for oxygen gas.

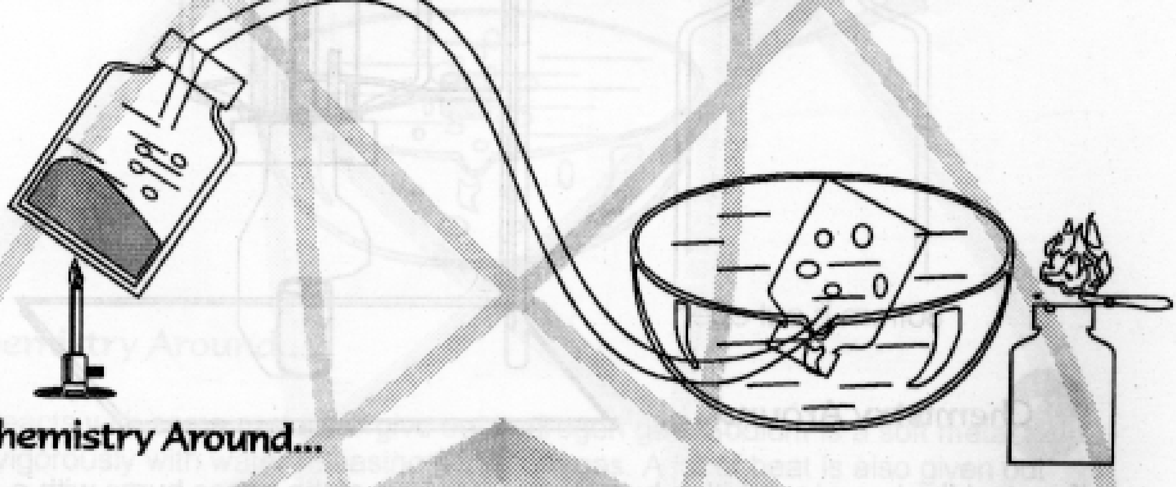
When electricity is passed through water it splits into its component gases. They are hydrogen (H_2) and oxygen (O_2).

Oxygen...

You need: Empty injection bottles, holder, potassium permanganate ($KMnO_4$), wide-mouthed bowl, rubber tube, burner or candle to provide heat.

What to do: Fill one empty injection bottle with potassium permanganate, $KMnO4$, powder. Close the lid. Make a hole in the lid of the bottle. Insert a rubber tube through the hole. Fill the bowl with water. Invert another empty injection bottle in the water. This arrangement is shown in the diagram.
Now heat the test tube over a medium flame Shake the bottle a little.

What happens: You can see bubbles of a gas being formed in the bottle. Collect this gas in bottles in the water bath. Keep the rubber tube in the bottle till the water level is going down in the bottle. Once a bubble escapes in the water in the bowl, secure the cap on the bottle filled with gas and collect the gas in another bottle. Try and fill as many bottles of gas as possible.
The collected gas can be tested with blue and red litmus paper to find out the nature of the gas. If a burning splinter is taken near to the gas, it burns with a larger flame.



Chemistry Around...

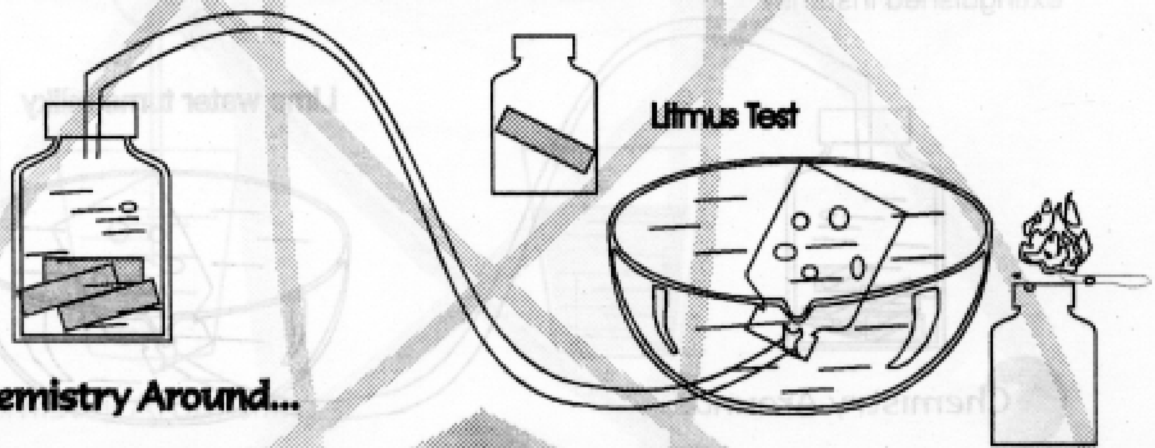
When potassium permanganate($KMnO_4$) is heated it decomposes to give out Oxygen gas (O_2). This is an endothermic (heat needs to be provided in the reaction) reaction. This reaction can also be called decomposition reaction as potassium permanganate gets decomposed into potassium manganate and oxygen gas.

Hydrogen...

You need: Empty injection bottles, holder, dil. Hydrochloric acid (HCl), pieces of aluminum foil or pieces of zinc (Zn) metal, wide-mouthed bowl, rubber tube.

What to do: Fill pieces of zinc or aluminum in one empty injection bottle. Close the lid. Make a hole in the lid of the bottle. Insert a rubber tube through the hole. Fill the bowl with water. Invert another empty injection bottle in the water. This arrangement is shown in the diagram.
Now add dilute hydrochloric acid to the zinc pieces. Shake the bottle a little.

What happens: You can see bubbles of a gas being formed in the bottle. Collect this gas in bottles in the water bath. Keep the rubber tube in the bottle till the water level is going down in the bottle. Once a bubble escapes in the water in the bowl, secure the cap on the bottle filled with gas and collect the gas in another bottle. Try and fill as many bottles of gas as possible.
The collected gas can be tested with blue and red litmus paper to find out the nature of the gas. If a burning matchstick is taken near to the gas, it burns rapidly making a pop sound. If this gas is filled in a balloon, the balloon flies upwards in the air.



Chemistry Around...

The above tests indicate that the gas obtained is hydrogen gas. When ever acids react with metals they form a salt of that metal releasing hydrogen. Hydrogen gas is lighter than air that is why the balloon flies up to the ceiling.

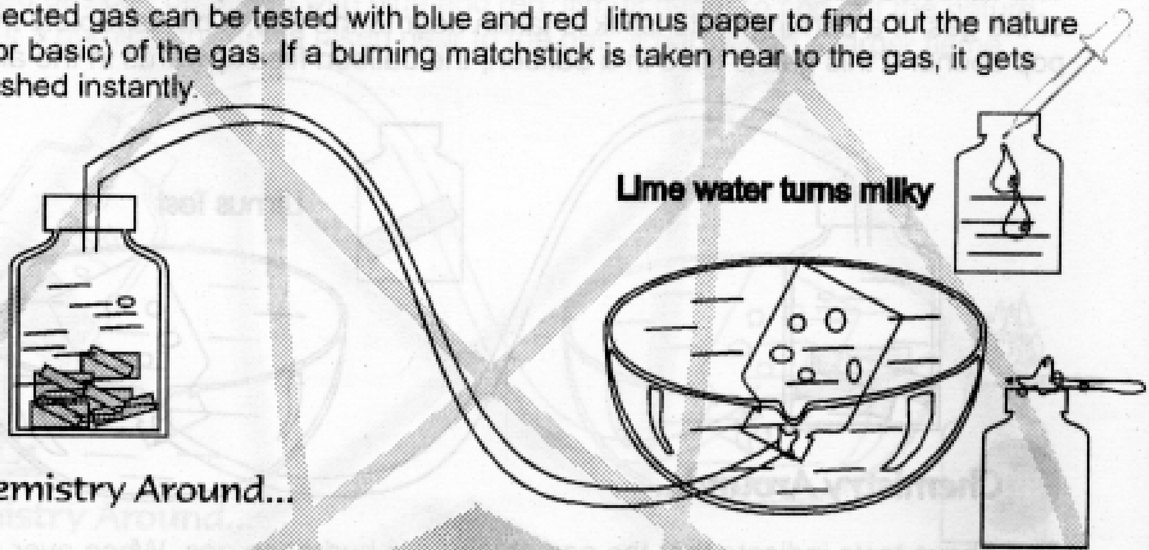
Hydrogen is a highly combustible gas. It burns with a loud sound.

The metal pieces are vanished in this reaction. Acids eat away the metals converting them into metal salts and hydrogen. That is why metal containers are never used to store sour things.

Carbon dioxide...

You need: Empty injection bottles, holder, dilute hydrochloric acid (HCl), pieces of marble, wide-mouthed bowl, rubber tube.

What to do: Fill pieces of marble in one empty injection bottle. Close the lid. Make a hole in the lid of the bottle. Insert a rubber tube through the hole. Fill the bowl with water. Invert another empty injection bottle in the water. This arrangement is shown in the diagram.
Now add dil. hydrochloric acid (HCl) to the marble pieces. Shake the bottle a little.
What happens: You can see bubbles of a gas being formed in the bottle. Collect this gas in bottles in the water bath. Keep the rubber tube in the bottle till the water level is going down in the bottle. Once a bubble escapes in the water in the bowl, secure the cap on the bottle filled with gas and collect gas in another bottle. Try and fill as many bottles of gas as possible.
The collected gas can be tested with blue and red litmus paper to find out the nature (acidic or basic) of the gas. If a burning matchstick is taken near to the gas, it gets extinguished instantly.



Chemistry Around...

Marble chips contain calcium carbonate. When hydrochloric acid is poured on it carbon dioxide gas is released. The chemical reaction taking place is written like this:

$$\underset{\text{Calcium carbonate}}{CaCO_3} + \underset{\text{Hydrochloric acid}}{2HCl} \longrightarrow \underset{\text{Calcium chloride}}{CaCl_2} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$$

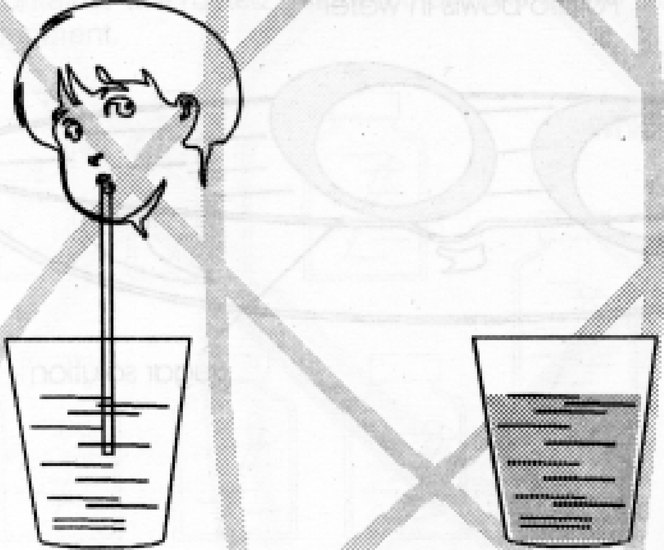
What's in my Breath...

We often say that our body uses the oxygen from the air we breath and gives out the car bon dioxide from the blood with the air we exhale. We shall test the breath we exhale for the presence of carbon dioxide in it.

You need: A clear glass, straw, lime water.

What to do: Pour some lime water in the glass. You will observe the colour of the lime water. It is colourless. Now take a deep breath. Then use the straw to exhale in the lime water. Repeat the process three to four limes.

What happens: The lime water will turn milky (whitish) in colour.



Chemistry Around...

Lime water has a property of turning milky in presence of carbon dioxide. The calcium present in lime water combines with CO_2 to form limestone which is an insoluble white powder. If this milky solution is allowed to stand still for some time this white powder will settle down at the bottom of the jar.

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

Calcium hydroxide	Carbon dioxide	Calcium carbonate	Water

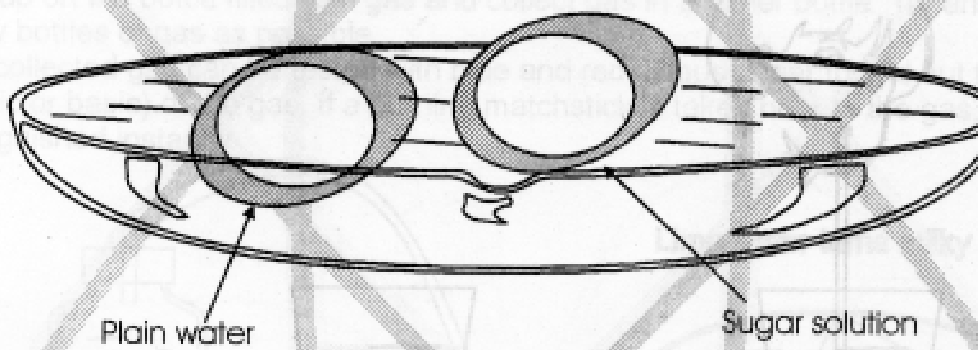
Osmosis...

What you need: Two large potatoes, sugar solution, large bowl, water.

What to do: Cut a potato in two halves. Scoop away the inner portion of potato halves to make a half a centimeter thick 'potato bowls'. Add plain water to one of the bowls. Add sugar solution to another. Make sure both the liquids are approximately up to the same height. Keep both these potato halves in a large plate filled with water. The water level in the plate should be below the height of the potatoes. Keep the potatoes for a while and observe.

What happens: The level of the sugar solution will increase inside the potato. The level of plain water shall remain the same.

Potato bowls in water



Chemistry Around...

The sugar solution is a stronger (has higher density) solution than water. Here potato will show the property of osmosis, and water from the surroundings will travel inside the potato. The other potato half has plain water. There is no difference in the strengths of the solutions so water does not travel inside or outside the potato wall.

Rusting of Metals...

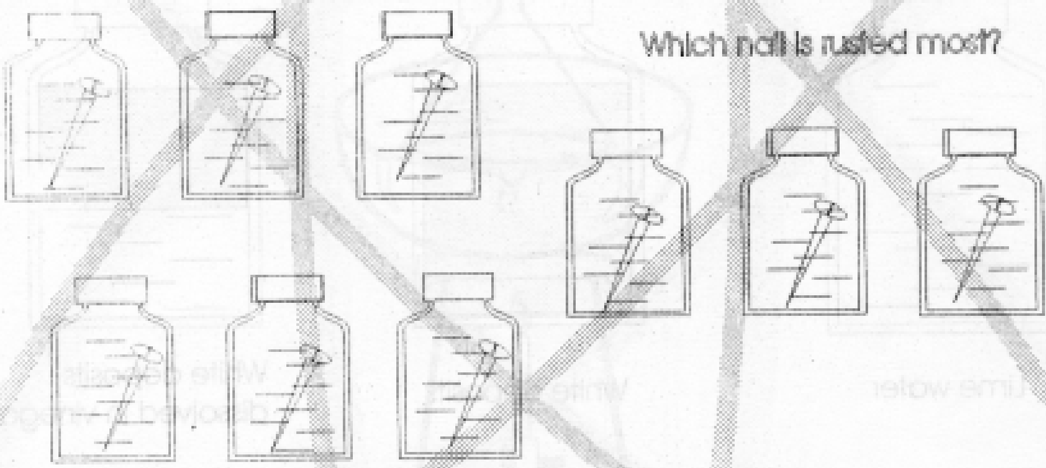
You need: Some iron nails, oil, salt water, boiling water, container jars, few lids.

What to do: Clean all the jars thoroughly. Fill the two jars with boiled water. Place a nail in each one. Close one of the jars with a lid. Let the other one be open. Fill plain water in third jar and place a nail in it.

Now soak three nails in oil. Place them each in three different jars containing salted water, plain water and mixture of water and sand.

Leave all the jars for a day.

What happens: The nails in the boiled water exposed container and plain water exposed container are rusted. All the other nails do not rust during the time taken to do the experiment.



Chemistry Around...

The closed jar does not allow the air to come in contact with the nail or water. So *that* nail does not rust. Also the nails which are protected with the layer of oil do not rust.

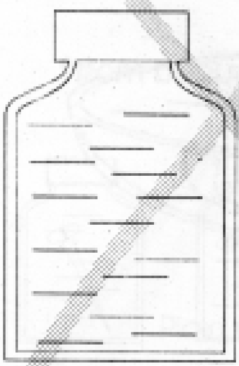
These observations are for the considered experiment time. All the nails may rust after a long passage of time.

Marble Deposits...

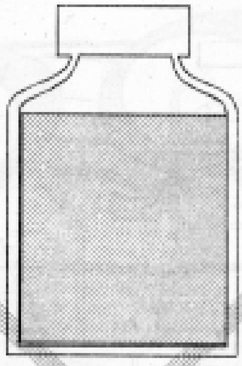
You need: Limewater, vinegar

What to do: Fill the jar to half with limewater. Leave the jar open outside. Leave it exposed for at least seven days. Discard the limewater. Note down the observations at this point. Now fill the same jar with vinegar. Leave it for some time. Observe the changes.

What happens: When limewater is discarded, a white layer of crust is formed on the inside wall of the jar. When vinegar is added to it, the air bubbles start to appear in the liquid and the white crust disappears till the vinegar is filled.



Lime water



White deposits

White deposits dissolved in vinegar

Chemistry Around...

Carbon dioxide from the air reacts with limewater leaving behind the limestone crust on the walls of the jar. Limestone reacts with vinegar releasing carbon dioxide bubbles. Pieces of limestone dissolve in the vinegar. The limestone crust remains intact where it does not come in contact with the vinegar.

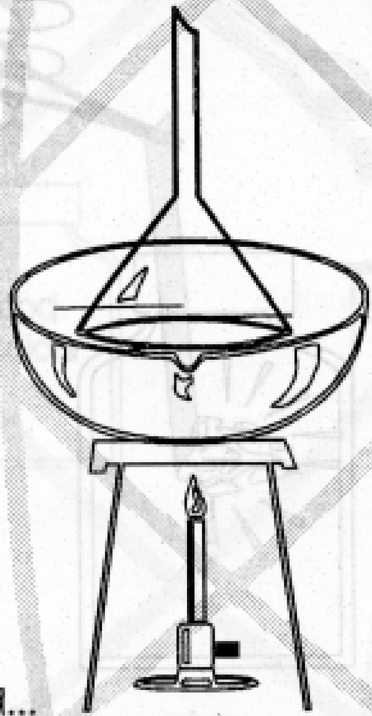
Carbon dioxide reacts with limewater forming a layer of calcium carbonate. Calcium carbonate reacts with vinegar (which is acetic acid) and is dissolved. Carbon dioxide gas is released in the reaction.

Evaporation and Sublimation...

You need: Iodine crystals, salt, glass funnel, burner or candle.

What to do: Mix iodine and table salt in a dish. Hold the dish over a flame. Now place the funnel over the dish as a lid as shown in the diagram. Let the mixture get warmer. Observe.

What happens: The iodine gets vaporised and moves upwards. It sublimates and sticks to the wall of the funnel. The salt is left behind in the dish.



Chemistry Around...

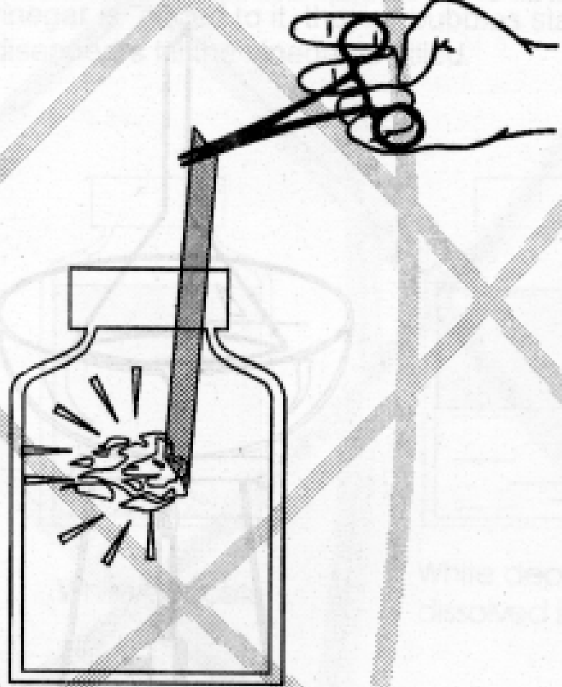
When the mixture of salt and iodine is heated, iodine being highly volatile, sublimates (changes state from solid to gas directly). The table salt has a distinct melting point and does not evaporate on heating. This method is used to separate two solid substances with different melting points. Here the property of iodine of not melting but sublimating is used to separate it from salt.

Oxidation...

What you need: Magnesium ribbon, pair of tongs, oxygen jar (oxygen can be prepared and stored in a glass jar as shown in the experiment preparing oxygen)

What to do: Hold one end of the magnesium ribbon with the pair of tongs. Heat the other side. As the ribbon burns, slowly introduce it in the oxygen jar.

What happens: The magnesium ribbon burns very brightly forming a white powder of magnesium oxide.



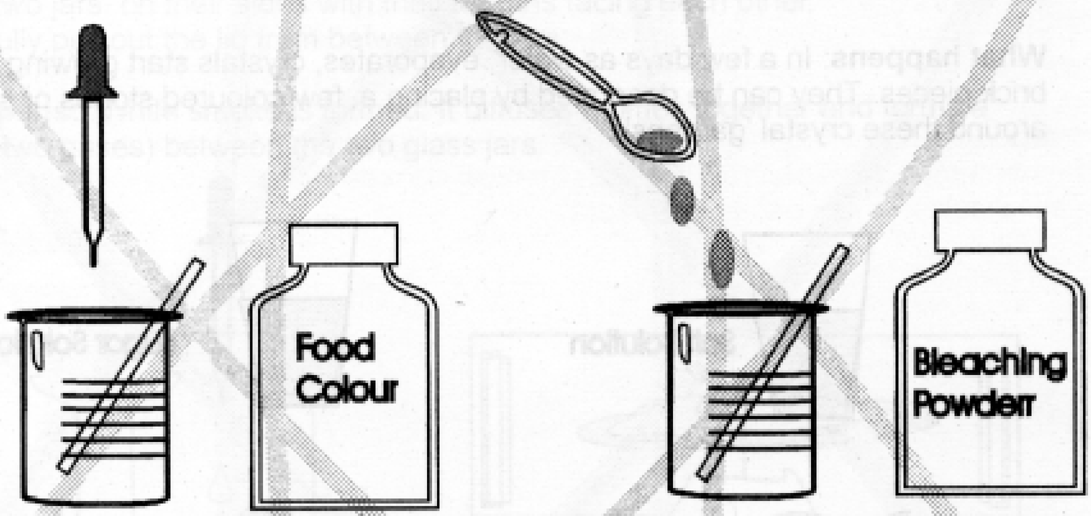
Chemistry Around...

Magnesium is oxidised (combined with oxygen) to magnesium oxide. The chemical equation of the above reaction is:

$$\underset{\text{Magnesium}}{2\,Mg} + \underset{\text{Oxygen}}{O_2} \longrightarrow \underset{\text{Magnesium Oxide}}{2\,MgO} + \text{heat}$$

Colour, Colour...What Colour?...

You need: Bleaching powder, food colour, glass, water
What to do: Take some water in the glass. Add few drops of food colour to it. Stir with the spoon. The water takes up the colour. Now add one teaspoon of bleaching powder to it. Stir again and wait and watch.,
What happens: The colour of the water starts fading and finally it vanishes leaving behind colourless water.



Chemistry Around...

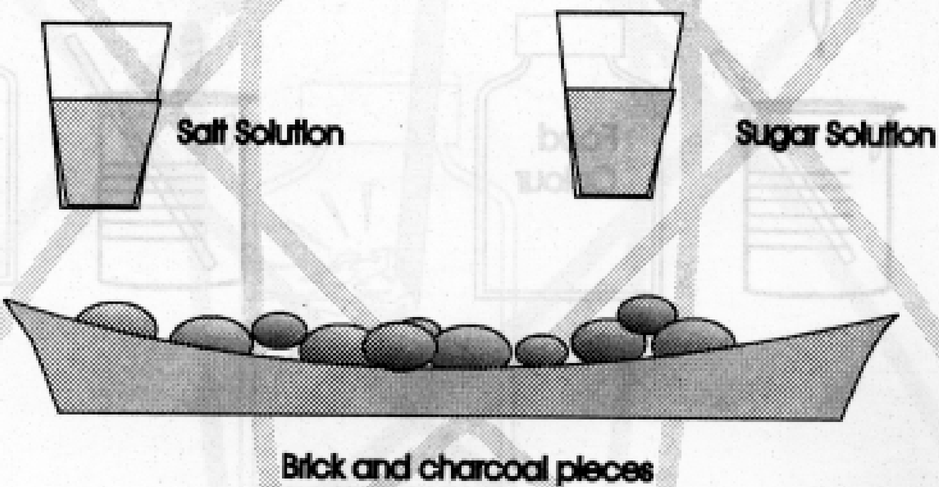
The addition of bleaching powder to the water releases oxygen. Oxygen combines with the colour. This is how colour disappears. .
The water shows colour because of mixing with the food colour. When oxygen combines with the food colour, it changes the chemical composition of the colour. The new chemical composition may not possess 'showing' colour as its characteristic. That is why water turns colourless.

Crystals on the Rocks...

You need: Salt, sugar, water, pieces of bricks, charcoal, tray, colour.

What to do: Add sugar in water till a saturated solution is made. Add some colour to it. Make a saturated solution of salt in the same way. Arrange the brick and charcoal pieces in a tray. Pour sugar and salt solution over these pieces generously. Keep the tray in the sunlight.

What happens: In a few days as water evaporates, crystals start growing on the brick pieces. They can be decorated by placing a few coloured stones or sea shells around these crystal 'gardens'.



Chemistry Around...

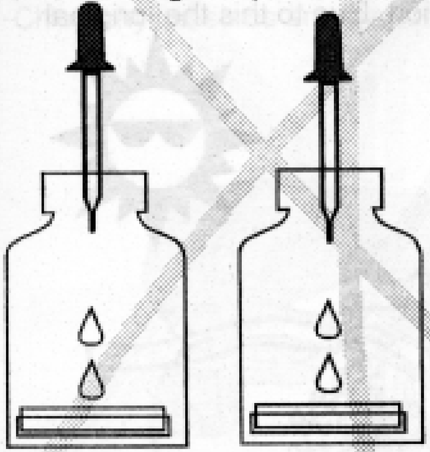
Charcoal and brick both are porous substances. They absorb the water faster from the solution helping the process of crystallisation (pure salt and sugar crystals are formed and grow rapidly). Salt and sugar crystals are white in colour and they form small bush like structures against dark coloured background of coal and brick.

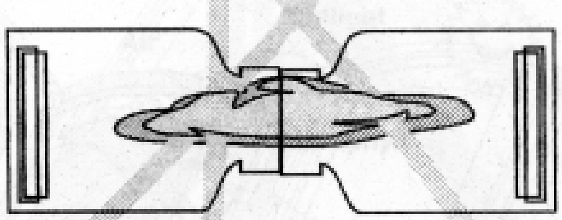
Diffusion of Gases...

What you need: Two gas jars containing 'liquid ammonia' and concentrated hydrochloric acid, two wads of paper (paper sheet folded several times)

What to do: Carefully pour a few drops of hydrochloric acid (HCl) on a wad of paper placed at the bottom of the one of the glass jars. Cover it with a piece of paper.
Pour a few drops of ammonia on another wad of paper and place it at the bottom of the second glass jar. Cover it with a paper lid.
Place the two jars on their sides with their mouths facing each other.
Now carefully pull out the lid from between the jars.

What happens: White smoke is formed. It diffuses (comes together and forms a mixture of two gases) between the two glass jars.





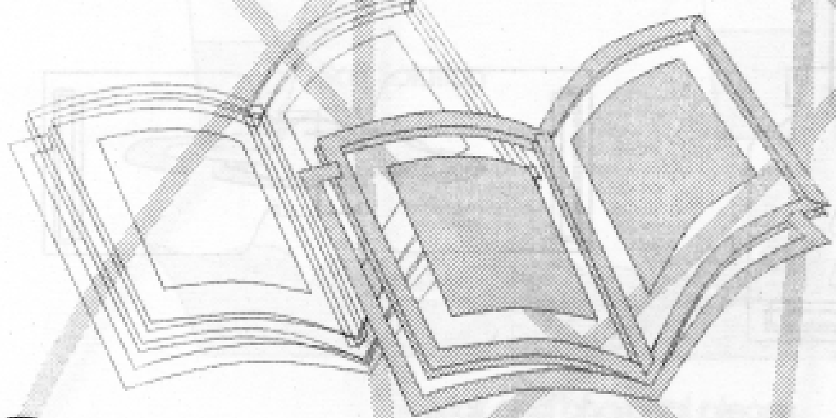
Chemistry Around...

The white smoke is a compound called ammonium chloride (NH_4Cl). It is formed as a result of a chemical reaction between the vapours of hydrochloric acid and ammonia. The smoke diffuses into both the jars.

Ageing Newspaper...

You need: Newspaper, place where sun's rays are available for a long time of the day.

What to do: Place the newspaper in such a place where sun's rays will fall on it for a long time of the day. Leave it there for at least five days.
The newspaper changes its colour from white to yellow and looks like a very old newspaper.
What happens: The raw materials used to make newspaper are yellow in colour. The colour of the paper looks white with the help of chemicals (bleaching reagents) added to it. These chemicals remove oxygen from the paper making it look brighter at room temperature. The paper is left in the sunlight where the air has higher temperature. The oxygen in the air combines with the chemicals in the paper at the higher temperature rearranging the chemical composition. Due to this the original yellow colour of the paper reappears.



Chemistry Around...

The bleaching reagents remove oxygen from the paper. Addition of oxygen helps the paper to get back its original yellow colour. This reaction occurs in opposite direction from most other reactions. All the papers turn yellow with long exposure to air. Sunlight acts as catalyst in this reaction - its heat increases the reaction temperature.

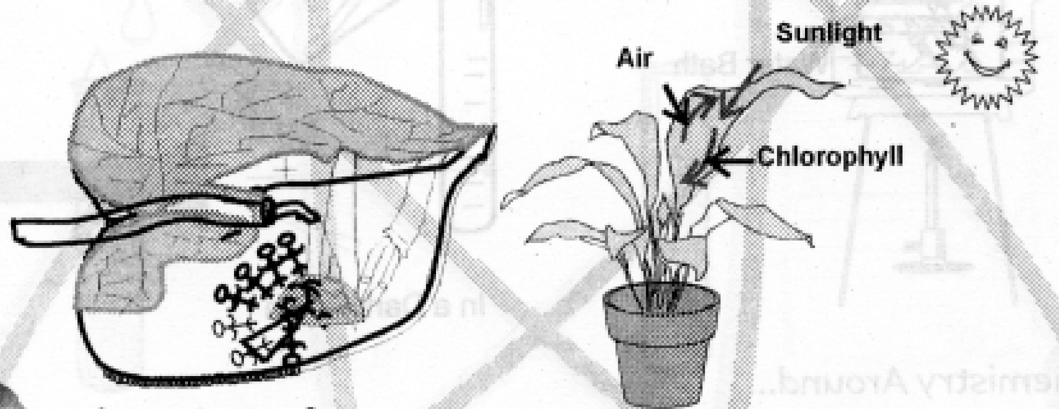
Photosynthesis...

You need: Two plants in pots, sunlight, water, black coloured plastic bag

What to do: Keep one potted plant in sufficient sunlight. Water the plant daily. Observe the growth.

Keep the other potted plant indoors. Cover the plant with black colour plastic to stop sunlight from reaching the leaves. Water the plant regularly. Observe.

What happens: The plant which is kept in sunlight gets good supply of sunlight and air which are necessary to produce food. This plant grows naturally with fresh green coloured leaves. The plant in the dark is not able to produce food as it does not get sunlight. The pigment called chlorophyll is present in the leaves of the tree. Plant prepares its food in presence of sunlight, water, air and chlorophyll.
Chlorophyll absorbs energy from sunlight.



Chemistry Around...

Photosynthesis In Plants

Photosynthesis is a combination reaction. During photosynthesis, sunlight provides the energy for combination of Carbon Di Oxide from air and water in presence of chlorophyll. The chemical reaction of plant food production is as follows:

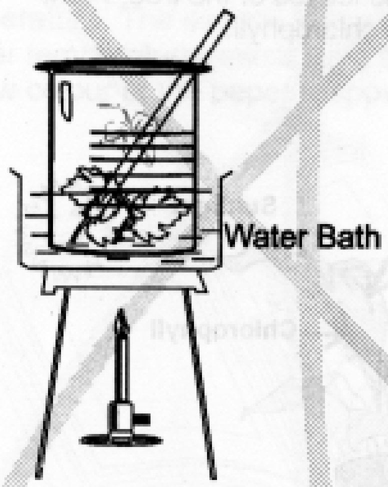
$$\underbrace{6CO_2}_{\text{Carbon dioxide}} + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6\ (\text{Glucose}) + 6O_2$$

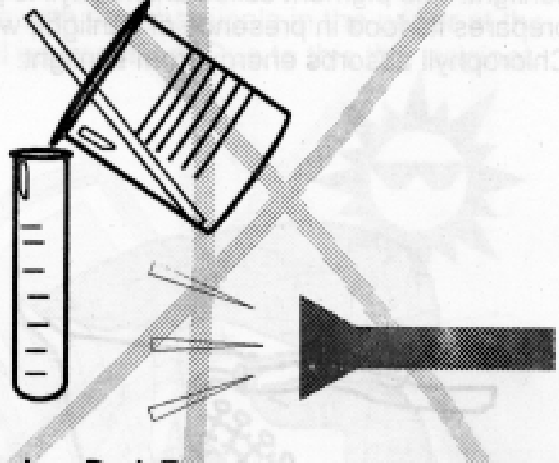
Fluorescence...

You need: Ethanol, burner, two to three leaves

What to do: Place a vessel with water for boiling. Then add ethanol to a beaker and place the beaker in the boiling water bath. Ethanol being highly volatile should not be placed on a flame directly. Boil 3-4 leaves in 50-100 ml ethanol for 3-5 minutes. The chlorophyll (the colouring pigment in the leaf) from the leaves will be removed and will be suspended in the ethanol solution. Remove these contents to a test tube. Without wasting any time turn off all of the lights. Shine a white light or torch on the test tube of chlorophyll.

What happens: The light will excite the electrons and they will emit energy in red light. It looks really 'cool'.





Chemistry Around...

A colouring pigment called chlorophyll is present in the leaves of the plant. Chlorophyll absorbs energy from the sunlight, which is used by the plant in preparing its food. This chlorophyll gets dissolved in the ethanol solution.

Chlorophyll pigment which is still in the ethanol solution radiates absorbed light. In the dark it shines and is still visible. This phenomenon is visible only for a short time as ethanol evaporates in the air in a very short time. It absorbs light of all colors but emits only red light.

Homogeneous Reaction...

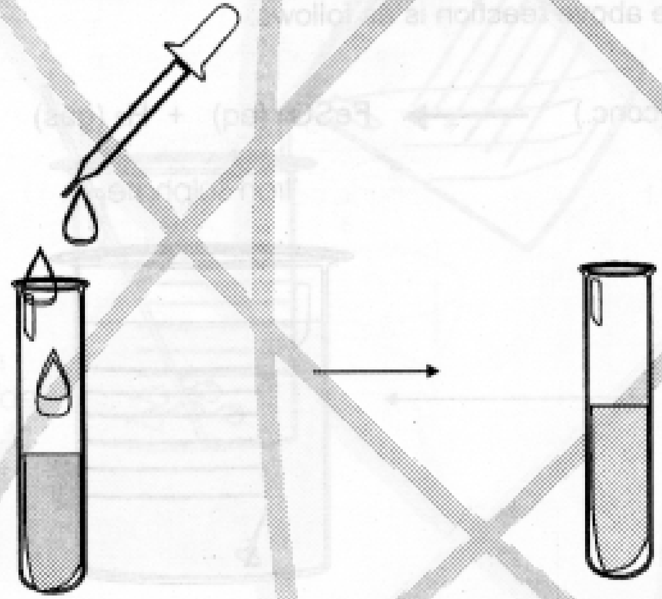
You need: Silver nitrate, sodium chloride solution, test tube

What to do: Take 5 ml solution of silver nitrate ($AgNO_3$) in a test tube. Add 5 ml of sodium chloride (NaCl) solution to it. Shake the test tube lightly and observe.

What happens: Chemical reaction takes place between the two solutions giving us a mixture of two different products.

The chemical equation of the above reaction is (aq. = aqueous):

$$\underset{\text{Silver nitrate}}{AgNO_3\,(aq)} + \underset{\text{Sodium chloride}}{NaCl\,(aq)} \longrightarrow \underset{\text{Silver chloride}}{AgCl\,(aq)} + \underset{\text{Sodium nitrate}}{NaNO_3\,(aq)}$$



Chemistry Around...

Solid, Liquid, gas are the three physical states of matter. If all the reactants and products taking part in a reaction are of the same physical state, the reaction is called a **homogeneous** reaction.

In the above reaction the reactants are silver nitrate and sodium chloride solution. The products are silver chloride and sodium nitrate in aqueous condition. All of them are in liquid state making the reaction homogeneous type.

All other homogenous reactions may not show precipitation but the end points could be different such as change in colour or evolution of gases, etc.

Deadly Sulphuric Acid...

You need: 1 normal sulphuric acid (H_2SO_4), iron nail, glass beaker.

What to do: Add 49 cc of sulphuric acid to 1 liter of water. This is 1 normal sulphuric acid. Fill the beaker to half with this H_2SO_4 solution. Dip the iron nail in this solution. Stay back and observe. Leave the beaker in this condition for some time.

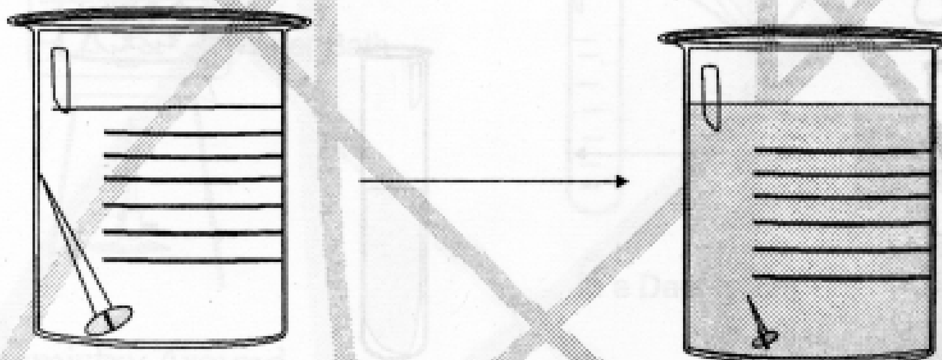
What happens: Sulphuric acid (H_2SO_4) reacts vigorously with iron nail, releasing bubbles of gas. The reaction is so fast and vigorous that after some time, the iron nail becomes thin and finally disappears. A green coloured ferrous sulphate ($FeSO_4$) solution is left in the beaker.

The chemical equation for the above reaction is as follows:

$$Fe + H_2SO_4(conc.) \longrightarrow FeSO_4(aq) + H_2(gas)$$

Iron + Sulphuric acid

Iron Sulphate



Chemistry Around...

Sulphuric acid is a very strong acid which has the capacity to eat up hard metals. One should be very careful while handling dilute or concentrated H_2SO_4.

This reaction takes place between a solid and liquid substance. That is why this is called a **heterogeneous** reaction.

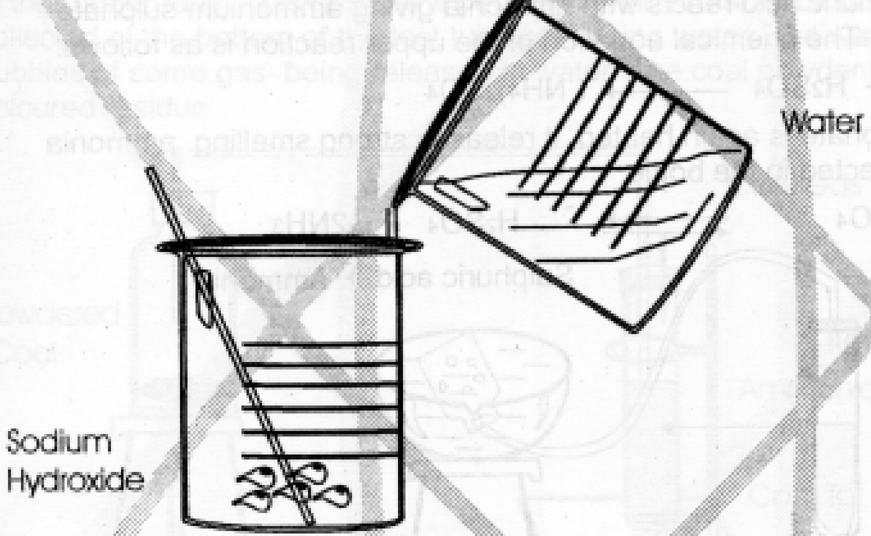
In this reaction, reactants were completely converted into products. This reaction proceeds only towards forming products. Such reactions are called **irreversible** reactions.

Exothermic Reaction...

You need: Sodium hydroxide (NaOH) pieces, water, beaker.

What to do: Take approximately 10 gm of sodium hydroxide flakes in a beaker. Add 100 ml water to the beaker and stir with glass rod. Feel the exterior of the beaker with your hand. Do not dip your finger in the solution.

What happens: You will feel the walls of the beaker turning warm.



Chemistry Around...

On addition of water to sodium hydroxide, heat is released into the surroundings.

In some reactions there is formation of new bonds or rearrangement of the bonds between the atoms. In such cases energy is released in the reaction. Which is why we can feel the rise in temperature of the beaker containing the solution. This is an **exothermic reaction.**

In some reactions bonds are broken to form products. Heat has to be provided externally for such reactions. They are called **endothermic reactions**.

Reversible Reaction...

You need: Dilute sulphuric acid (H_2SO_4), liquid ammonia, test tube, holder, tube, bottle.

What to do: Take 5 ml liquid ammonia in the test tube. Add slowly 5 ml of dilute sulphuric acid H_2SO_4 to it. Shake a little. A reaction takes place and products are formed in the test tube. Now place the cork with a tube attached on the test tube. The other end of the rubber tube should be in an inverted bottle in a water trough. Heat the test tube on a low flame. Observe.

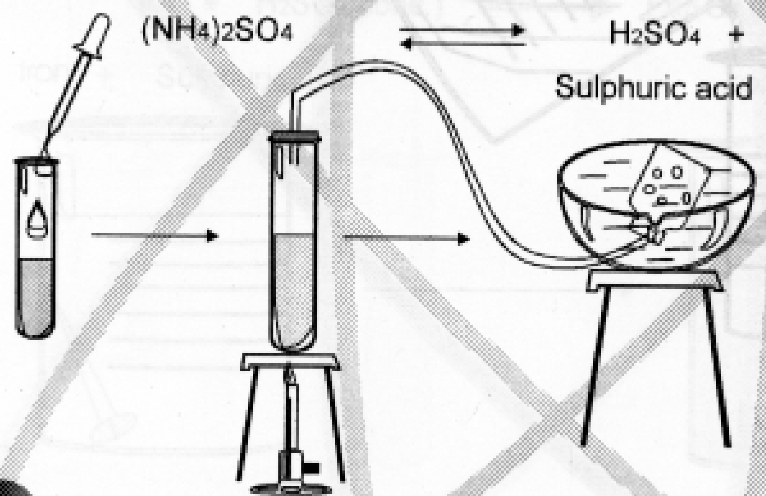
What happens: Sulphuric acid reacts with ammonia giving ammonium sulphate $(NH_4)_2SO_4$ and water. The chemical equation of the upper reaction is as follows:

$$2NH_3 + H_2SO_4 \longrightarrow (NH_4)_2SO_4$$

When ammonium sulphate is again heated, it releases strong smelling ammonia gas which can be collected in the bottle.

$$(NH_4)_2SO_4 \rightleftharpoons H_2SO_4 + 2NH_3$$

Sulphuric acid + Ammonia



Chemistry Around...

A chemical reaction where only part of the reactants gets converted into products is a reversible reaction. Such a reaction can proceed in forward and backward direction.

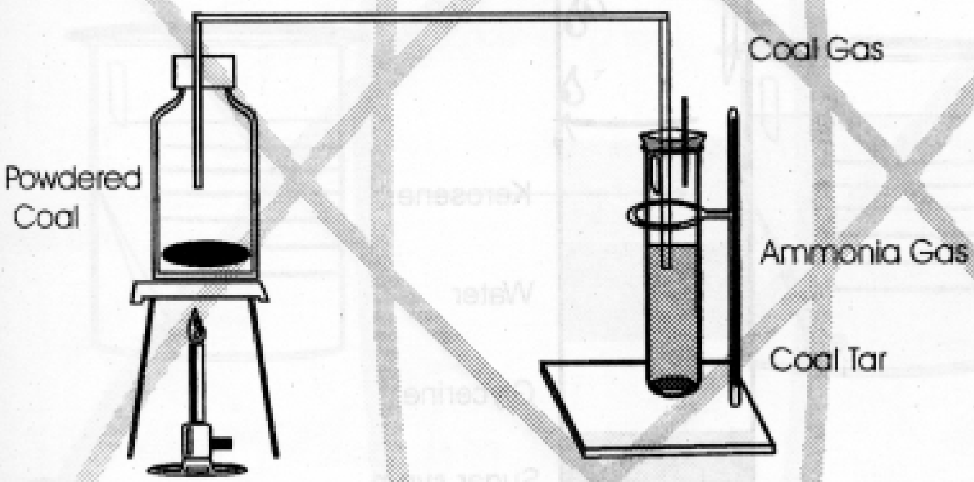
In the above reaction, a salt, ammonium sulphate, $(NH)_2SO_4$ was formed as a product. But when heat is supplied, water combines with the sulphate ion to form sulphuric acid, and ammonia gas is released.

Distillation of Coal...

You need: Two test tubes, powdered coal, burner, stand, water, corks with two holes, rubber tubes.

What to do: Arrange the stand, test tubes, burner and rubber tubes as shown in the diagram. Put some water in the empty test tube. Take some powdered coal in the test tube and heat it over the flame. Observe.

What happens: As the coal gets heated, a gas starts to escape through the free end of the rubber tube. This gas has a peculiar smell. A black coloured substance is collected at the bottom of the test tube containing water. The water also shows bubbles of some gas being released in water. The coal powder turns into a black coloured residue.



Chemistry Around...

As the coal is heated, it gets decomposed into various things. The gas which escapes through the rubber tube is called coal gas. The black coloured residue is coal tar. When the water is tested with litmus paper, it turns red litmus paper blue. The strong smell is ammonia. The black residue left behind in the test tube is called coke.

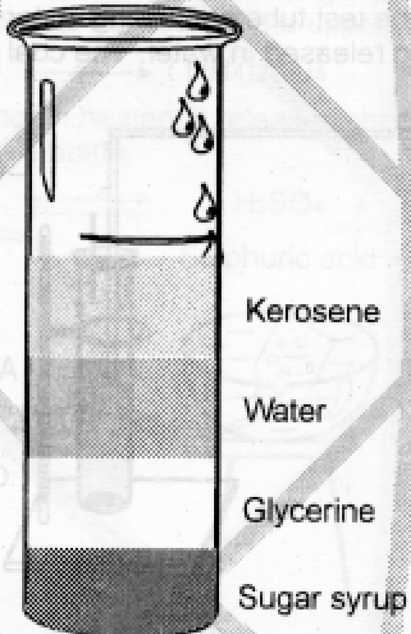
This is a type of decomposition reaction.

Liquid Column...

You need: Tall glass, water, red ink, blue ink, kerosene, glycerine, sugar syrup (make saturated sugar solution and reduce it to half by boiling.)

What to do: Add a few drops of blue ink to the sugar syrup. Pour this solution in a tall glass. Then add glycerine very slowly along the walls of the glass so the syrup layer is not disturbed. Then add a few drops of red ink to the water and pour it slowly over glycerine. Then make a layer of kerosene over water.

What happens: The glass will show layers of different liquids.



Chemistry Around...

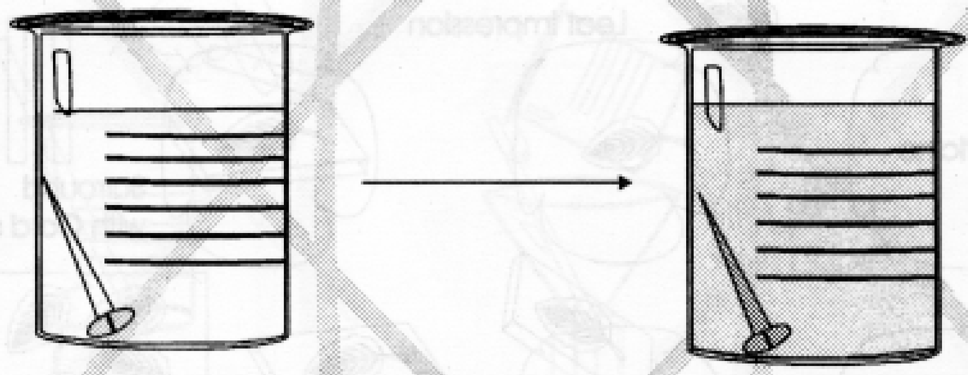
The different liquids have different density. If the soluble layers are kept separate from each other, the glass or the container will show the liquids forming separate layers. The heavier liquids will settle down and lighter liquids will float on the upper side. Some of these liquids are miscible (can mix) with each other. While forming this interesting liquid column we must take care that immiscible liquids - those that cannot mix - are kept in adjacent layers.

Replacement Reaction...

You need: Copper sulphate solution ($CuSO_4$), beaker, iron nail

What to do: : Fill the copper sulphate solution ($CuSO_4$) in the beaker till 3/4ths. Dip the iron nail in the solution. Leave it for half an hour. Observe.

What happens: The iron nail turns pinkish in colour and the solution turns pale green in colour.



Chemistry Around...

A displacement reaction takes place between copper sulphate and iron. The copper ions (pink in colour) are deposited on the iron nail and the iron ions (green in colour) replace copper in copper sulphate solution, forming ferrous sulphate.
The chemical equation of the above reaction is:

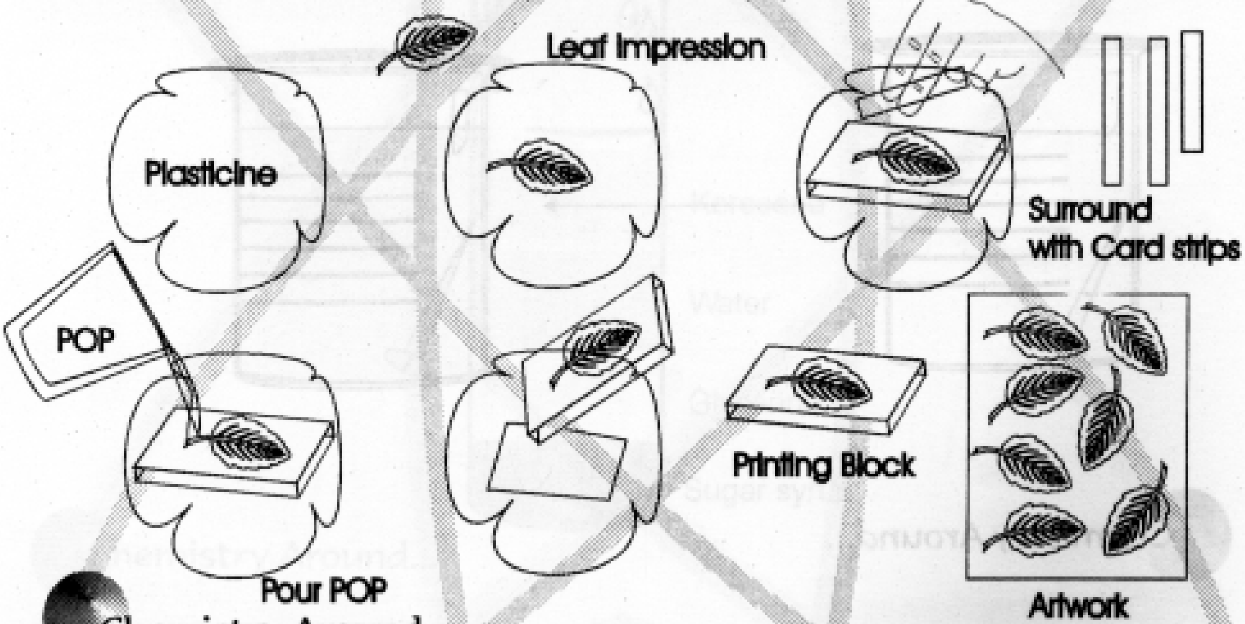
$$\underset{}{Fe} + \underset{\text{Copper Sulphate}}{CuSO4} \longrightarrow \underset{\text{Ferrous Sulphate}}{FeSO4} + Cu$$

Block Printing...

You need: Plaster of Paris or POP ($CaSO_4.1/2H_2O$), plasticine clay (an oil-based clay), leaf with impressive vein structure, glass, cardboard, colours.

What to do: Knead the plasticine well and flatten it out . Roll it up to get an even surface. Press the leaf very gently to get an impression on the surface. Remove the leaf. Take a strip of cardboard and surround the leaf impression. Secure with cellotape. Make a paste of Plaster of Paris with water. Stir well for even consistency. Pour it in the card mould over the leaf impression. Leave it overnight to set.

What happens: When Plaster of Paris is set, remove the mould, peel away the plasticine. The card strip can be pulled away too. This is a ready printing block. Dip it in the colours and create beautiful patterns on the paper.



Chemistry Around...

Plaster of Paris sets to form a solid block. It takes the shape of the mould it is poured in. This printing block can be used several times. Do not stamp very hard with it -- it will preserve longer.

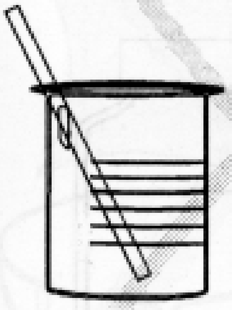
Changing Colours...

You need: Medium size beaker, funnel, conical flask, potassium permanganate ($KMnO_4$) solution, sodium hydroxide (NaOH) solution, filter paper or cotton wool.

What to do: Take 20 ml of potassium permanganate ($KMnO_4$) solution in a beaker. Add 20 ml sodium hydroxide (NaOH) solution to it. A violet coloured solution will be obtained. Make the filter ready with filter paper or cotton wool. Place it in a conical flask.

Now pass the permanganate solution through the filter paper.

What happens: The violet coloured permanganate solution turns green after passing through the filter paper. The filtrate collected in the flask shows green colour.



$KMnO_4$ + NaOH

Chemistry Around...

Potassium permanganate solution is in an alkaline medium. When this solution is filtered, the cellulose from the filter paper reduces the $KMnO_4$ to green coloured manganate (K_2MnO_4) potasium magnate.

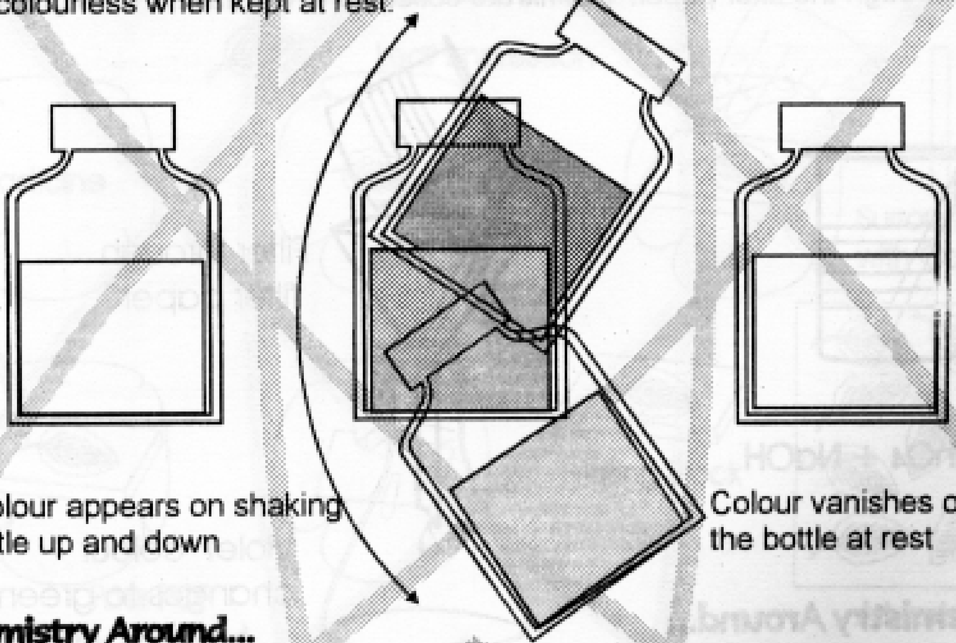
Permanganate ion (Violet) $\longrightarrow$ Manganate ion (Green)

Blue Bottle...

You need: Sodium hydroxide ($NaOH$) solution, methylene blue indicator, glucose powder, empty bottle with tight lid.

What to do: Take 200 ml sodium hydroxide ($NaOH$) solution in a bottle. Add 10 gm of glucose to it. Add few drops of methylene blue indicator to the bottle. Mix the solution by shaking the bottle and keep it aside.

What happens: The solution in the bottle turns colourless when kept at rest. Now shake the bottle again and solution will turn blue. Allow the bottle to stand and solution will become colourless. Shake the bottle again to obtain a blue solution. It will turn colourless when kept at rest.



Blue colour appears on shaking the bottle up and down

Colour vanishes on keepir the bottle at rest

Chemistry Around...

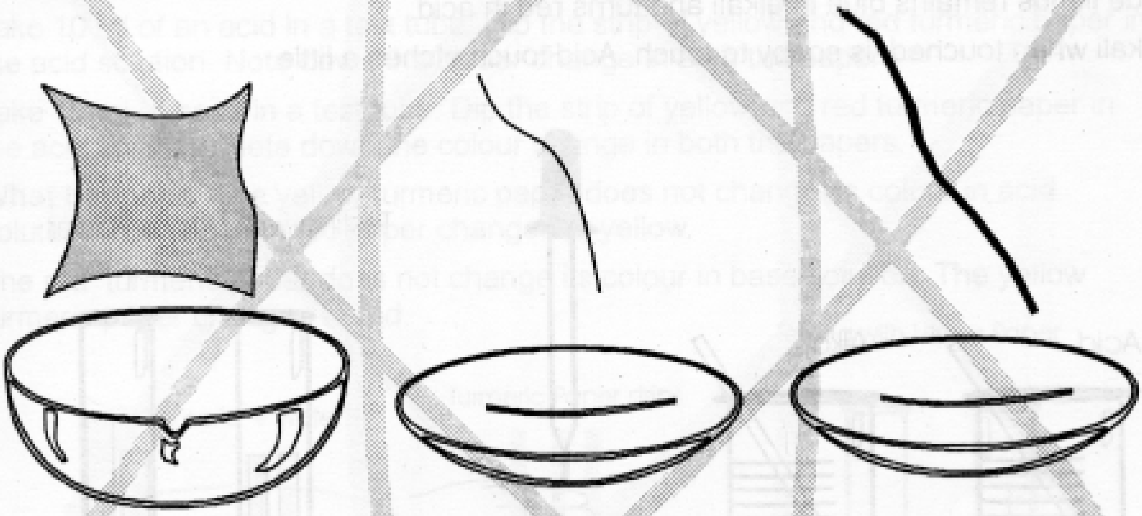
Methylene blue is reduced to colourless form by alkaline glucose solution. When the bottle is shaken, the indicator is oxidised by the oxygen (combines with oxygen) in the air and it appears in its original blue colour. At rest, it again is reduced to colourless form.

Caustic Behaviour...

You need: Sodium hydroxide (NaOH), water, large glass jar, pieces of cotton cloth, wool, hair, etc.

What to do: Dissolve 5 gm of solid sodium hydroxide (NaOH) in 100 ml of water. This will make a strong basic solution. Heat this solution carefully to the boiling point. Now dip the pieces of cotton cloth, wool and hair in it. Observe.

What happens: The cotton cloth, wool, and hair get dissolved in the strong caustic solution.



Strong Caustic Solution

Chemistry Around...

Wool and hair are protein-based materials. They dissolve in the caustic (NaOH) solution. Cotton is mostly cellulose, a polymer of many glucose molecules. It does not dissolve in sodium hydroxide solution.

Test for Acids and Base...

You need: Dilute acid (HCl), dilute alkali (NaOH), blue litmus paper, red litmus paper.

What to do: Fill dilute acid in two different test tubes. Dip one blue litmus paper in one test tube and red litmus paper in other.

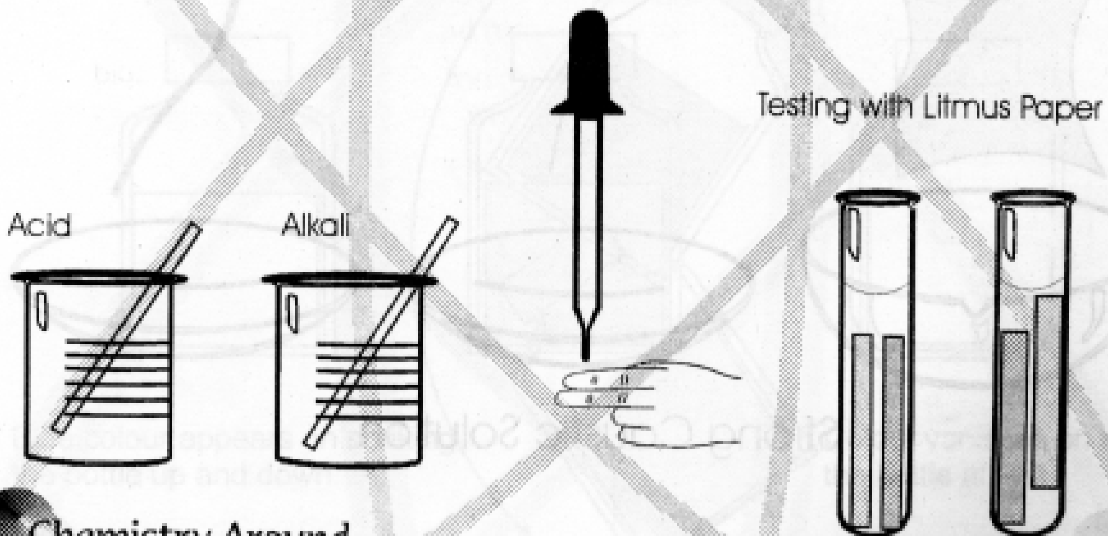
Also fill two test tubes with alkali. Dip red litmus in one and blue litmus in another.

Take a drop of acid and alkali on your hand and feel the touch.

What happens: Red litmus paper turns blue in alkali and remains red in acid.

Blue litmus remains blue in alkali and turns red in acid.

Alkali when touched, is soapy to touch. Acid touch etches a little.



Chemistry Around...

The word 'acid' has been derived from the Latin word 'aciduous' which means sour. Every substance that has acid in it is sour in taste.

Bases or alkali are bitter in taste and soapy to touch. Alkalis are compounds which are chemically 'opposite' to acids.

Litmus is a dye obtained from lichen, a type of algae, and it exhibits red colour with acids and blue colour with alkalis.

Turmeric Paper...

You need: Turmeric powder, water, filter paper, dilute acid, alkali.

What to do: Take one spoonful of turmeric powder in a bowl. Add sufficient water to make a paste of turmeric. With help of a spoon spread this turmeric paste on a filter paper. Allow the filter paper to dry. This is yellow turmeric paper.

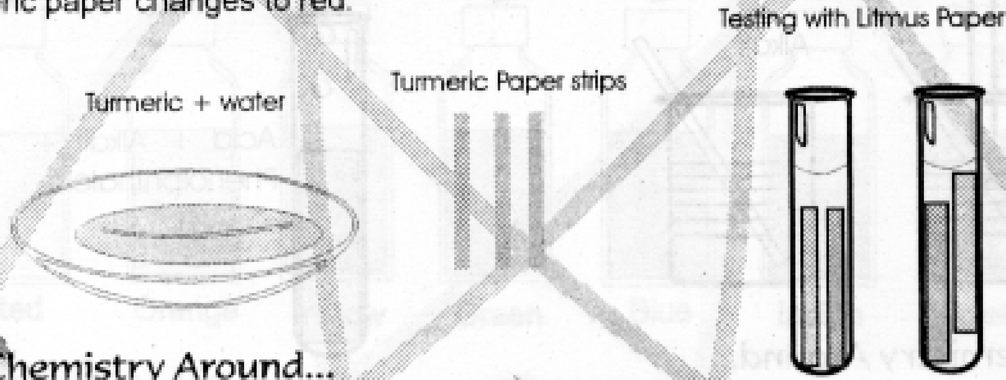
Now add few drops of sodium hydroxide to the turmeric paste. The paste will change the colour from yellow to red. Spread this paste over another filter paper. Allow the paper to dry. This is the red turmeric paper ready to be used as an indicator paper for acid-base testing.

Take 10 ml of an acid in a test tube. Dip the strip of yellow and red turmeric paper in the acid solution. Note down the colour change in both the papers.

Take 10 ml of base in a test tube. Dip the strip of yellow and red turmeric paper in the acid solution. Note down the colour change in both the papers.

What happens: The yellow turmeric paper does not change its colour in acid solution. The red turmeric paper changes to yellow.

The red turmeric paper does not change its colour in base solution. The yellow turmeric paper changes to red.



Chemistry Around...

Turmeric acts as an indicator in an acid-base reaction. Neutralisation reaction also can be carried out using turmeric paste as an indicator.

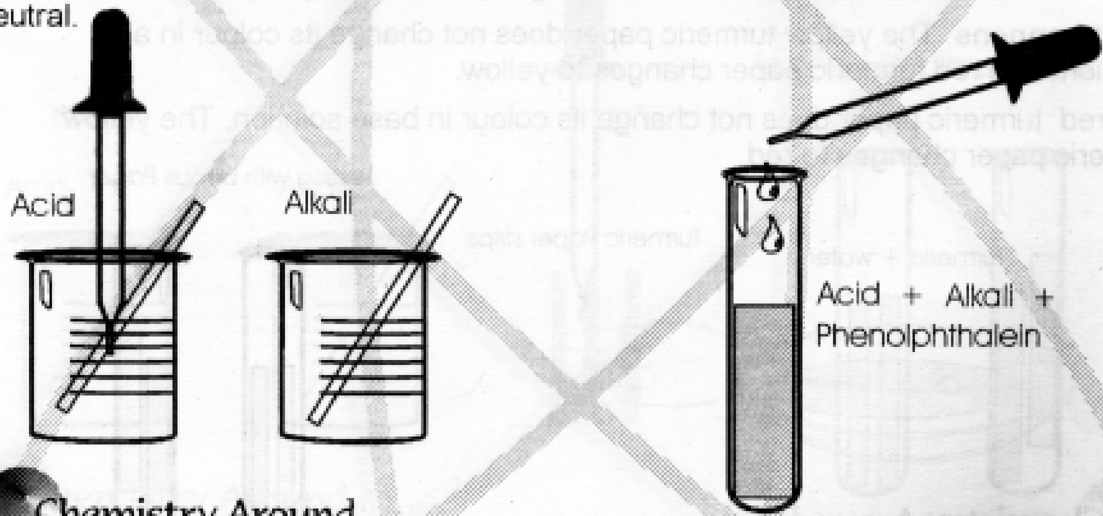
Neutralisation...

You need: 0.1 N hydrochloric acid (approx3.65 gms of hydrochloric acid (HCl) dissolved in 1000 ml of water), 0.1 N sodium hydroxide (approx4.0 gm sodium hydroxide dissolved in 1000 ml water), phenolphthalein indicator, dropper, test tube.

What to do: Take 10 drops of dilute hydrochloric acid (HCl) in the test tube with a dropper. Add two drops of phenolphthalein indicator to it. Shake the solution a little. Do you see any change of colour in the solution? Now with another dropper, add drops of NaOH solution to the test tube with constant shaking. Do it very slowly and count every drop. Keep adding the drops of NaOH till the solution in the test tube turns pink in shade. The end point of this reaction is when the solution turns pink and retains that colour.

At this point test the solution in the test tube with blue and red litmus papers.

What happens: When the solution is tested with litmus paper it does not show any change in the colour of the litmus paper. Therefore we can say that the solution is neutral.



Chemistry Around...

When an acid is added to an alkali or an alkali is added to an acid, they completely react with each other and there is no acid or alkali left in the solution - this process is called neutralisation. Salt and water are the products of this reaction.

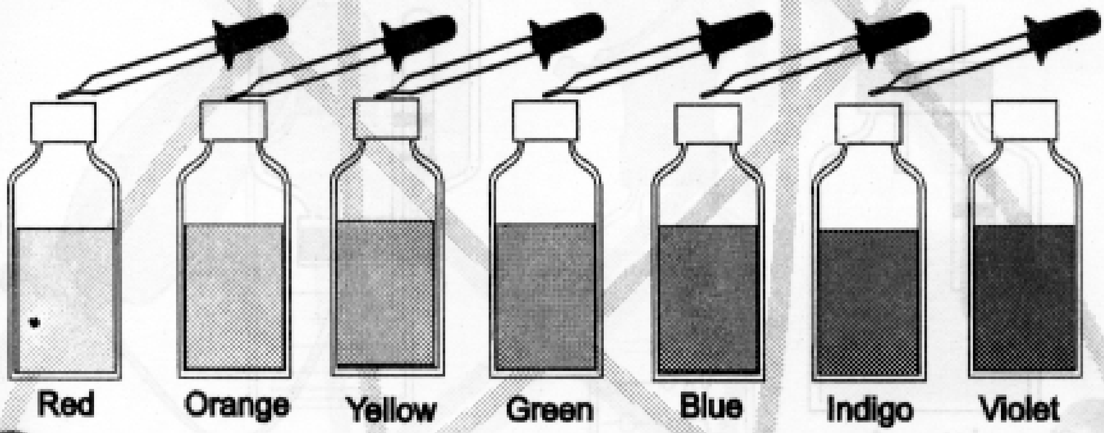
We add an indicator to the reaction to show us the end point of the reaction. Indicator is a substance which shows different colours in different conditions. Phenolphthalein is an indicator which shows pink colour in basic or alkaline conditions. It remains colourless in acidic conditions.

Rainbow Colours...

You need: .1 N (3.65 gms of HCl dissolved in one liter of water) hydrochloric acid solution, sodium hydroxide solution, universal Indicator, empty bottle for reaction.

What to do: Fill the bottle to half capacity with water. Add 10 drops of universal indicator to the bottle. Now with help of a dropper, add hydrochloric acid solution to the bottle till the colour of the solution turns red. While adding the solutions shake the bottle horizontally so that contents of the bottle mix properly. Now with another dropper add drops of sodium hydroxide solution to the bottle. Observe carefully.

What happens: The colour of the solution changes from red to orange to yellow to green to blue to indigo to violet. Add the hydrochloric acid drops the same way and the solution will show colour change from violet to red. Use different droppers for acid and alkali.



Chemistry Around...

This is a titration(drop wise addition of solution of known concentration to a solution of unknown concentration.) between hydrochloric acid and sodium hydroxide. The universal indicator responds to the change in pH (acidity or basicity) of the solution and shows corresponding colours. The universal indicator shows colours of rainbow depending on the acidic or alkaline concentration of the liquid.

Fire Extinguisher...

You need: Hydrochloric acid, sodium bicarbonate, large glass bottle with tight rubber lid, small bottle or test tube, glass rods, plastic tube, rubber tube.

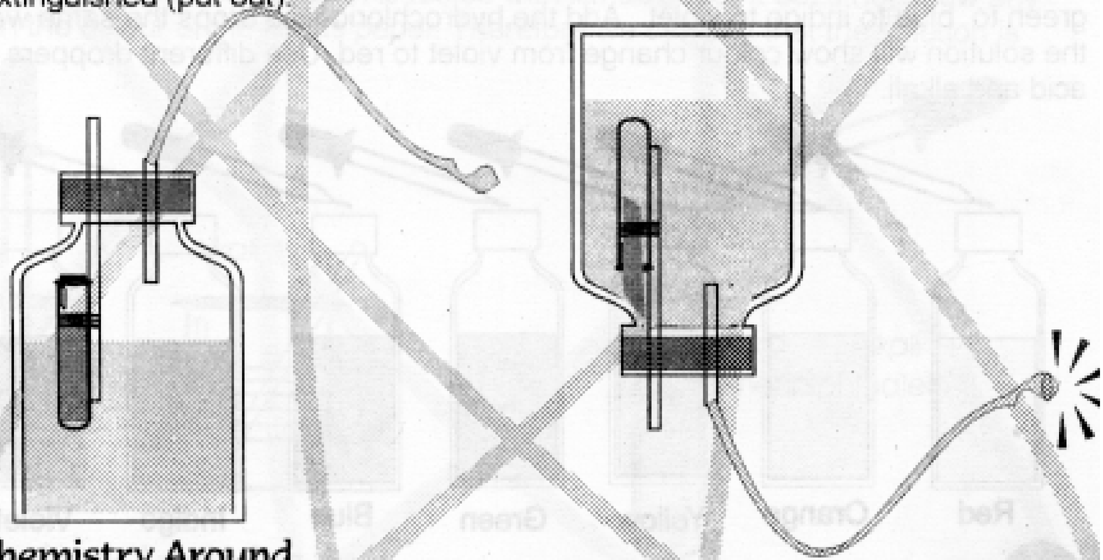
What to do: Fill half of the bottle with water. Add one tablespoon sodium bicarbonate. Stir well to dissolve the powder. Make two holes in the rubber lid of the bottle. Assemble the plastic exit tube, rubber tube and nozzle (refer figure below).

Insert the glass rod through another hole of the lid. Fill the small bottle with the acid carefully. Tie this bottle to the glass rod near the bottom.

Fix the lid on the bottle.

Turn the bottle upside down. Point the nozzle in the direction of the target (Fire).

What happens: A gas comes out of the nozzle. If this nozzle is aimed at fire, fire gets extinguished (put out).



Chemistry Around...

Acid mixed with carbonated water gives carbon dioxide gas. Carbon dioxide extinguishes the fire. In commercial fire extinguishers, a similar arrangement of chemicals and apparatus is made. The acid bottle gets opened on pulling the trigger of the red coloured fire extinguisher box.

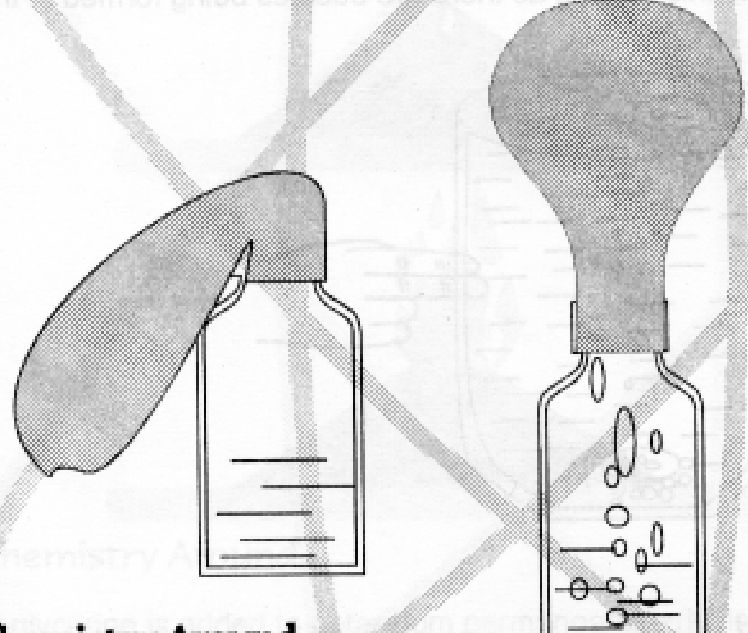
Blow a Balloon...

You need: Sodium bicarbonate ($NaHCO_3$), bottle with small neck, vinegar, balloon.

What to do: Fill the bicarbonate powder inside the balloon by stretching the neck of the balloon. Fill the glass bottle with vinegar to the half of its capacity. Now stretch the neck of the balloon over the mouth of the bottle and fix it there. The balloon should be fixed carefully without letting the bicarbonate powder fall in the bottle.

When you want to blow the balloon, hold the neck of the bottle tight and lift the balloon vertically.

What happens: The balloon gets inflated in a few seconds.



Chemistry Around...

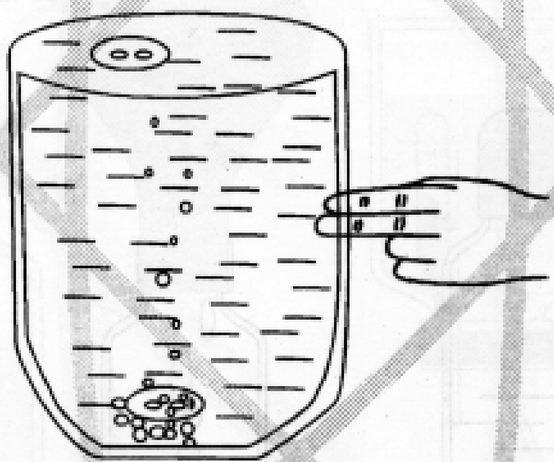
As the balloon is stood up vertically, the bicarbonate powder inside the balloon falls in to the bottle of vinegar. The reaction between the bicarbonate and vinegar (acetic acid) produces carbon dioxide gas. This gas fills up in the balloon inflating it.

Dancing Button...

You need: Glass, water, sodium bicarbonate, citric acid dissolved in water, shirt buttons.

What to do: Fill the glass with water. Add a spoonful of sodium bicarbonate powder to it. Stir well. Now add 5 to 7 drops of citric acid. Drop a shirt button in the glass. See bubbles gathering near the shirt button holes. 'Instruct' the button to come up. Then 'ask' it to go down.

What happens: When you ask the button to come up, it will! If you ask it to sink, it will do that too!! The button is going to do this upward and downward movement. You make sure to co-ordinate your instructions with the speed of the button. You can make the button dance like this as long as there are bubbles being formed in the water.



Chemistry Around...

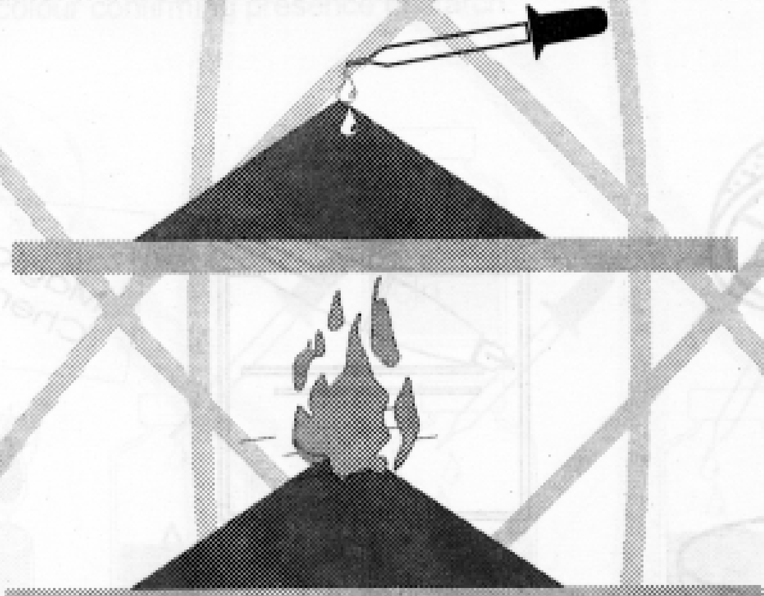
When we add citric acid to the carbonated water, carbon dioxide bubbles is formed in the water. These bubbles are accumulated near the button hole. At a certain point, these bubbles form film under the button and push it upwards. The bubbles break as they come to the surface. The button is pushed down by gravity. New bubbles gather at the buttonhole and push it up again. This dance continues as long as new bubbles keep gathering near the button hole.

Fire Mountain...

You need: Potassium permanganate ($KMnO_4$), glycerine ($C_3H_5(OH)_3$), dropper, stone or aluminum foil.

What to do: Make a heap of the potassium permanganate ($KMnO_4$) on the dry stone surface. This heap can also be made on an aluminum foil. Now add few drops of glycerine on this heap with dropper. Stand back for a minute.

What happens: The heap of potassium permanganate ($KMnO_4$) will catch fire in few seconds time. It will burn with a flame.



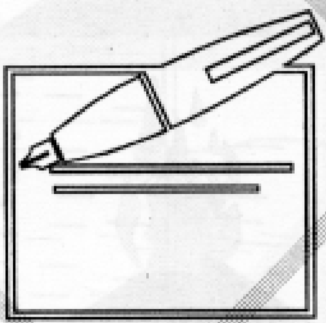
Chemistry Around...

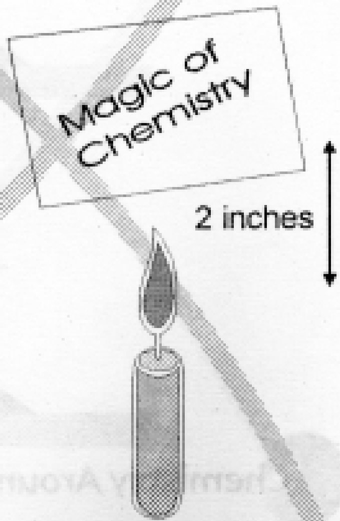
When glycerine is added to potassium permanganate ($KMnO_4$), it combines with oxygen provided by the potassium permanganate ($KMnO_4$) (potassium permanganate ($KMnO_4$) reduces to release oxygen). Oxidation of glycerine (combining with oxygen) is an exothermic reaction (heat is released in this reaction) resulting in to fire. In this continuous reaction, black coloured manganese trioxide (Mn_2O_3) and white potassium carbonate (K_2CO_3) are produced.

This experiment should be performed with care. The fire produced gives an impression of a burning mountain.

Secret Messages...

You need: Lemon, pen nib to write, paper, candle
What to do: Squeeze the lemon to get the juice. Dip the pen nib in this juice and write with it on the paper. Let the paper dry. The writing cannot be seen on the paper. Light the candle. Hold this paper two inches away but over the flame . The paper can get the heat of the flame. Be careful not to burn the paper.
What happens: As the lemon juice gets warmed, it will turn brown and the writing will be visible.





Chemistry Around...

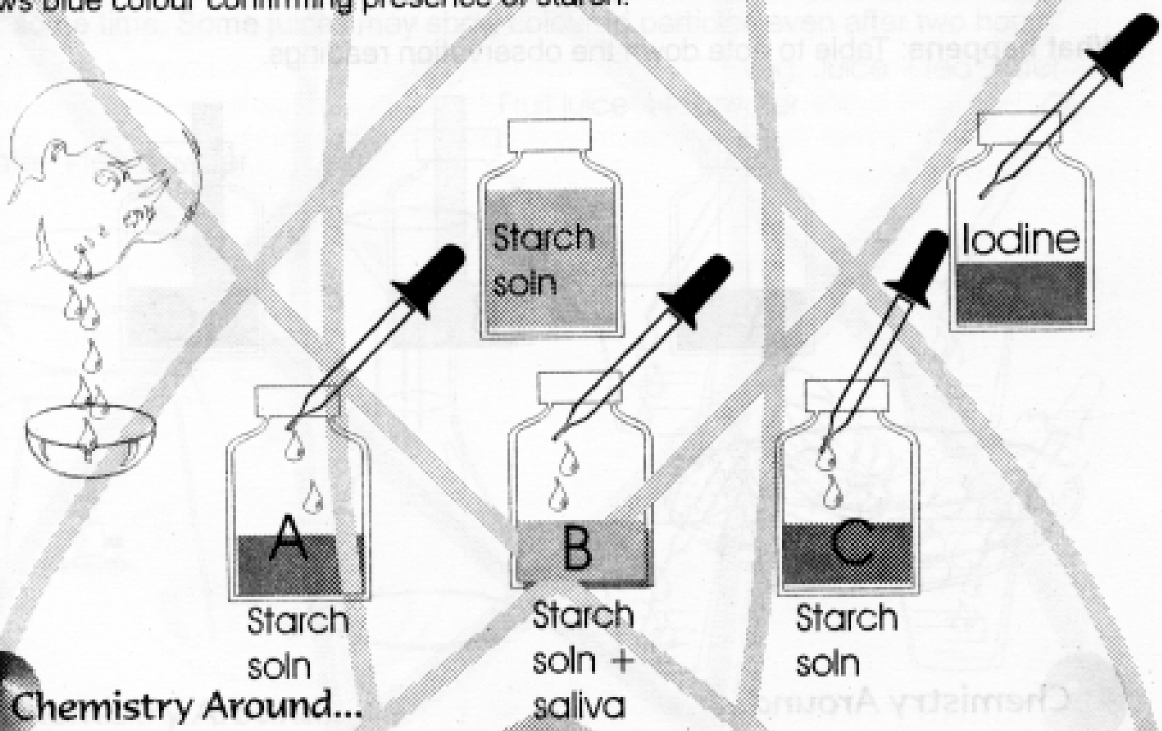
Lemon juice has citric acid present in it. It combines with the cellulose in the paper. When heated in presence of acid, cellulose undergoes chemical changes to give the brown colour.

Mouthful Chemicals...

You need: Test jars, starch solution, iodine solution, saliva from the mouth

What to do: Take starch solution in three different test jars. Label them as Jar A, B, and C. Now add two drops of iodine solution to jar A. It will change colour to dark blue confirming the presence of starch. Add saliva to jar B. Put Jars B and C aside for about six hours. Afterwards add drops of iodine solution to these two jars.

What happens: Jar B does not show blue colouration on addition of iodine. Jar C shows blue colour confirming presence of starch.



Chemistry Around...

Saliva contains an enzyme called amylase. Amylase breaks down (converts) starch into glucose. If iodine is added to glucose it does not turn blue. That is why the jar with saliva does not show blue colouration.

Enzymes are present in the saliva and other digestive parts of the body. They help in the digestion of food. They act as catalyst (increase the speed of digestion) by helping in breaking bigger hydrocarbon chains in to smaller ones. Enzymes can work only at certain suitable temperatures.

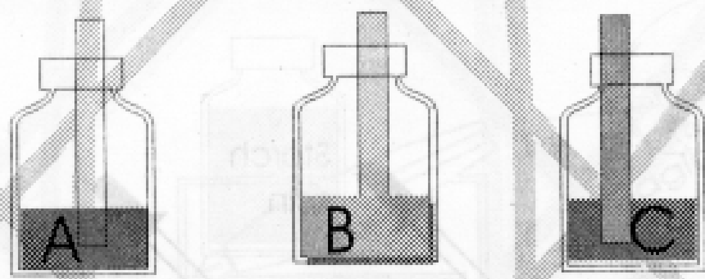
Tasty Tasty Acids...

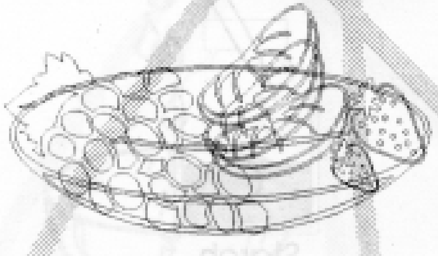
You need: Fresh fruit juice samples such as lemon, pineapple, orange, etc., glasses, pH papers, red and blue litmus papers.

What to do: Take different juice samples in different test tubes. Label all the test tubes. Dip blue litmus paper in each of the test tubes. Also dip the red litmus paper in each of the test tubes. Note down the colour change in a table.

Dip pH paper in each juice sample to determine the pH of the juice. Note down the readings referring to the colour chart given on the box of pH papers.

What happens: Table to note down the observation readings.





Chemistry Around...

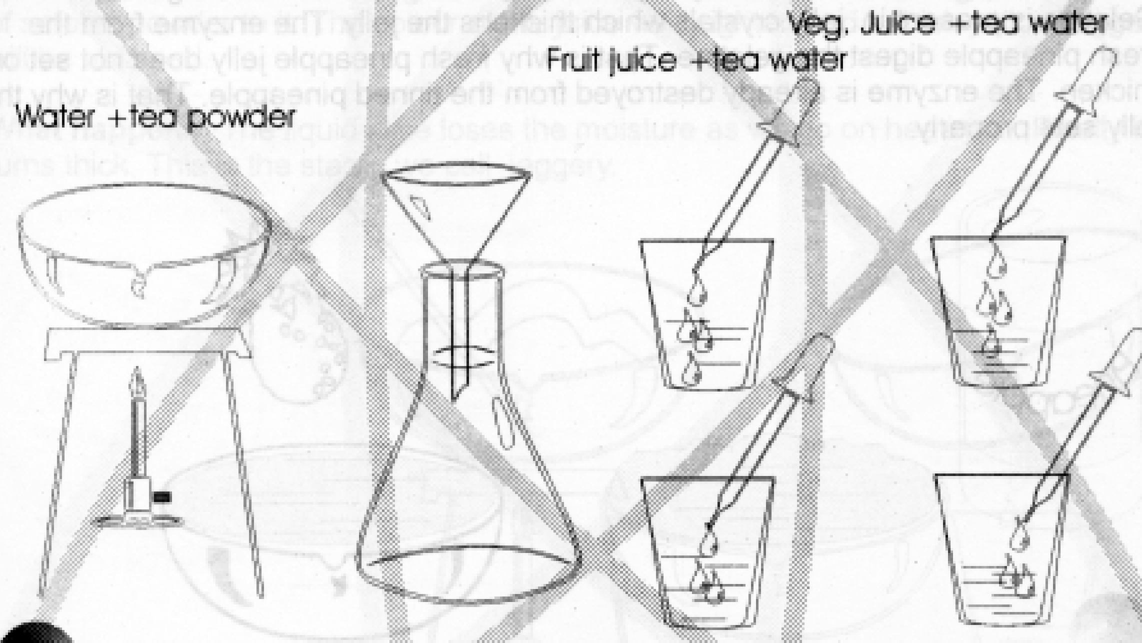
Fruits and vegetables contain different organic acids. This we infer as the fruit juices show pH value less than 7(acid-like pH), that is, hydrogen ions are present in higher concentration. Similarly, acids show change of colour in blue litmus paper to red when dipped in it. This confirms the presence of acids in the fruit juices.

Juice made of Iron...

You need: Juice samples of vegetables and fruits, tea powder, water, glasses, burner

What to do: Heat some water in a pan and tea powder to it. Boil for few minutes and strain the solution. The tea decoction is ready. Now take samples (two tablespoons) of the vegetable and fruit juices in different glasses. Label each glass. Now add two tablespoons of tea water to it and stir. Allow the solutions to stand for a long time. Note your observations after every half an hour.

What happens: You will see coloured particles gathering at the bottom of the glass after some time. Some juices may show coloured particles even after two hours.



Chemistry Around...

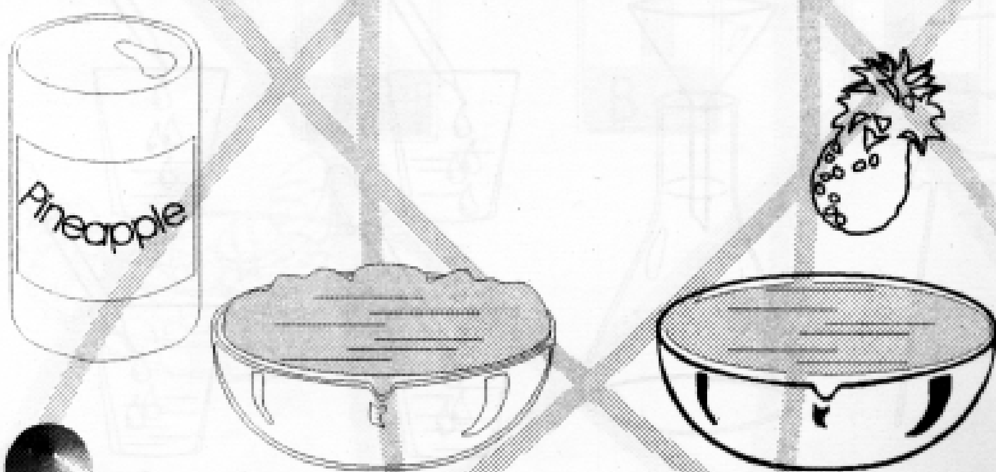
The chemicals present in the tea combine with the iron present in different juices to form coloured particles which settle at the bottom of the glasses.

Some juices form coloured particles on addition of tea solution contain more amount of iron as in it. Some juices take time to show this reaction as amount of iron present in them is less. Some juices may not show this reaction at all as iron is absent in them.

Pineapple Ate up My Jelly...

You need: Fresh pineapple pieces, tinned pineapple, jelly crystals, warm water, containers.

What to do: Dissolve the jelly crystals in warm water by constant stirring. Divide this solution in two different containers. Add pieces of fresh pineapple to one of the containers and set aside for setting. Now add pieces of tinned pineapple to another container and allow it to set. Check both the containers after two hours.
What happens: Jelly with tinned pineapple pieces sets properly. But the jelly with the fresh pineapple does not set.
Fresh pineapple contains an enzyme which digests the protein called gelatine. Gelatine is present in jelly crystals which thickens the jelly. The enzyme from the fresh pineapple digest the gelatine. That is why fresh pineapple jelly does not set or thicken. The enzyme is already destroyed from the tinned pineapple. That is why this jelly sets properly.



Chemistry Around...

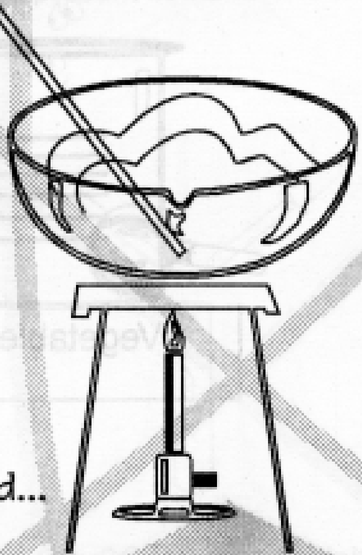
The enzymes present in digestive system of the body digest the proteins. They can work only at suitable temperatures (higher than room temperature but not very high). They often become inactive at very high temperatures. Tinned pineapple is boiled. So the enzymes present in pineapple become inactive due to high temperature .
In our body, these enzymes speed up the process of digestion. They help the protein molecules break into amino acids.

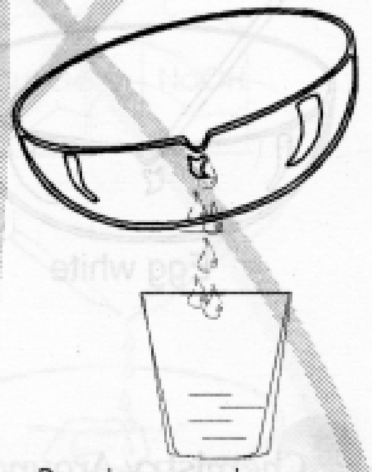
Sweet, Sweet Jaggery...

You need: Fresh sugarcane juice, pan, stirrer, burner, safolite powder (reducing agent to remove impure colouring matter form sugarcane juice which evaporates away.)

What to do: Place the pan on the burner. Heat the sugarcane juice with constant stirring. As the juice starts boiling, it changes its colour and turns blackish. Soon, the impurities start floating on the top of the juice. They should be removed with the spoon. Continue to boil the sugarcane. After a while it starts thickening. Add a pinch of safolite powder to it. The colour of the juice will brighten and a thick yellow jaggery will be obtained.

What happens: The liquid juice loses the moisture as we go on heating it. Finally it turns thick. This is the stage we call jaggery.





Pour jaggery in a mould to cool

Chemistry Around...

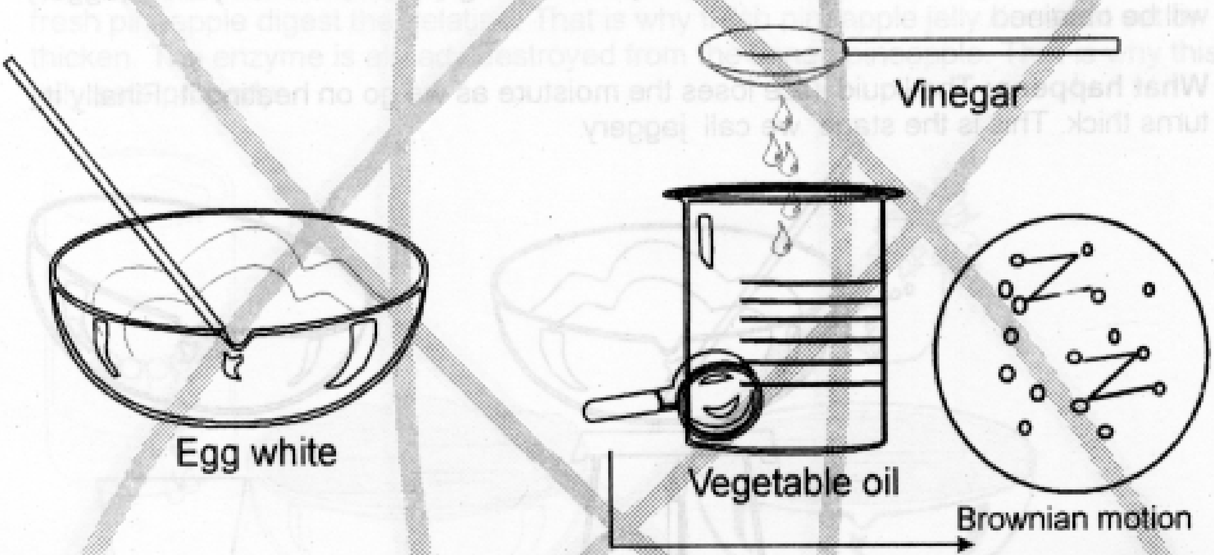
The sugar present in the sugarcane juice is turned into user friendly and storage friendly form by converting it into thick jaggery. The safolite powder acts as reducing agent reducing (removing oxygen and hence colour) any colouring matter and impurities from the sugarcane juice.

Creamy Mayonnaise...

What you need: An egg, half a cup of vegetable oil, one tablespoon vinegar.

What to do: Add one tablespoon of vinegar to the vegetable oil. Mix them. Both the solutions will separate after some time. Beat an egg in a bowl. Add mixture of vegetable oil and vinegar drop by drop to it with constant stirring. Continue to add till the entire oil and vinegar are used up.

What happens: After some time, a creamy white solution is formed which is called mayonnaise.



Chemistry Around...

Mayonnaise is an example of an emulsion or colloid. A colloid is a substance in which extremely small particles of a substance are mixed and remain suspended in another substance. These particles are groups of molecules or atoms in motion. In colloidal suspension, smaller particles in motion bounce around larger particles in suspension. This random motion of atoms or molecules called Brownian motion (first clearly explained by Einstein in 1905) It can be seen with help of a microscope.

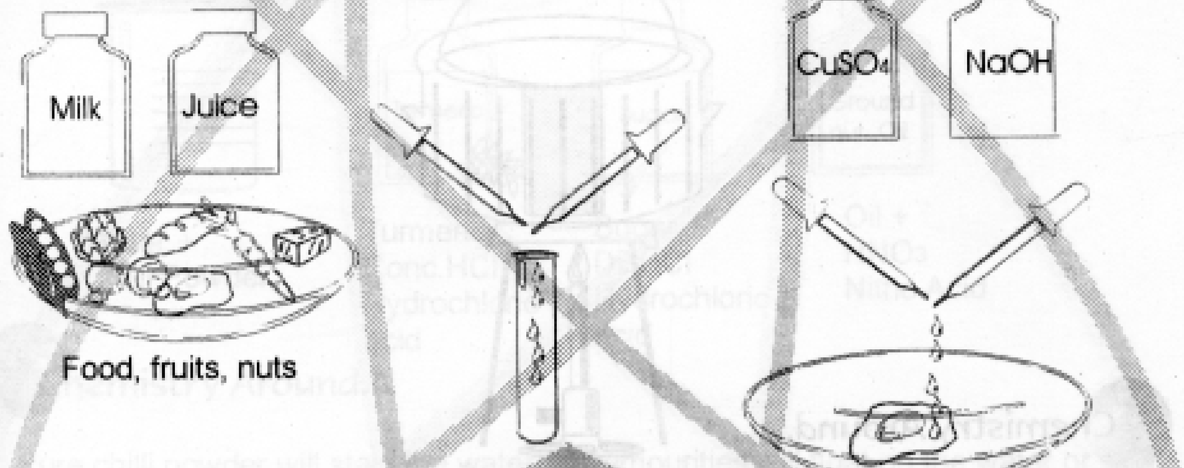
Proteins in My Food...

You need: Various food samples, copper sulphate solution ($CuSO_4$), sodium hydroxide solution (NaOH), small glass jars.

What to do: Take the food sample in the test tube or small jar and add some water to it. Do the same with other food samples in other test tube.-one food sample per test tube.

Take a little milk in one test tube . Add two to three drops of copper sulphate ($CuSO_4$) solution to it. Also add two to three drops of sodium hydroxide (NaOH) solution. Shake it a little. This is the reference test. Now add copper sulphate ($CuSO_4$) and sodium hydroxide (NaOH) solutions to other test tubes with food samples. Observe and note the results.

What happens: Milk is rich in protein substance. When tested with $CuSO_4$ and NaOH it shows deep blue coloration. Similarly the other food samples will show deep blue coloration if proteins are present in them. The test will not show blue colour in the absence of proteins.



Food + CuSO4 (Copper sulphate) + NaOH(Sodium hydroxide)

Chemistry Around...

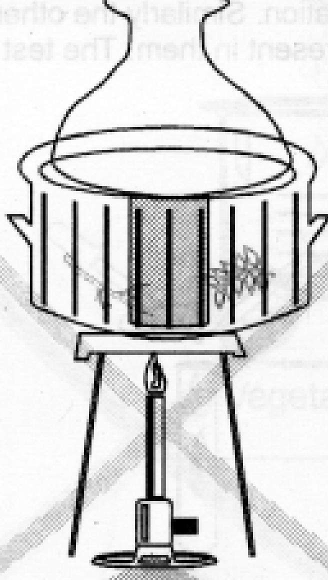
Different components are present in different kinds of food. We can find out presence of proteins in a particular food sample. More than one kind of nutrients can be present in one kind of food. From your observations make a list of foods in

Spice oils from Ajwain...

You need: Ajwain --*Carom ajowan, omam* (Tamil), *ajmo* (Gujarati) -- seeds, water, large stainless steel vessel, tall stainless steel . Container, round-bottomed vessel to fit on the top of the large vessel, water, burner.

What to do: Place 200 gm Ajwain seeds in the large SS (stainless steel) vessel. Add water in sufficient quantity. Place the tall vessel in the middle of the large vessel. The level of water in the large vessel should be less than the tall vessel. Fill water in the round-bottomed vessel and place it on top of the large vessel. This round-bottomed container will also act as a lid on the large size vessel. Light the burner and let the contents boil for some time. Allow it to boil till the water in the top vessel gains temperature.

What happens: When you remove the top vessel you will find the extracts of essential oils of ajwain collected in the inside tall vessel.



Chemistry Around...

In the given arrangement of different vessels, the upper round-bottomed vessel acts like a condensation flask. The ajwain seeds are being boiled in the water. The essential oil extracts turn into vapor state, travel upwards, get condensed on the round-bottomed flask and because of the peculiar shape, get collected in the tall vessel inside.

Is My Food Pure?...

You need: Groundnut or cottonseed oil, sugar, turmeric powder, chilli powder, dilute Nitric acid (HNO_3), concentrated hydrochloric acid (HCl), water.

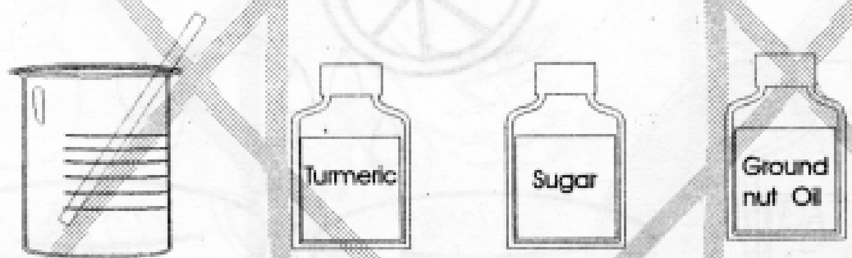
What to do: Solubility test for chilli powder: Fill water in a beaker. Sprinkle some chilli powder on it. Observe whether it floats on the water or sinks.

Test for turmeric powder: Take a little turmeric powder in a small jar. Add 5 ml concentrated hydrochloric acid (HCl). Observe and note down the colour change.

Test for sugar: Take half a spoon of sugar in a jar and add 5 ml dilute hydrochloric acid HCl to it. Observe if any brisk bubbles of carbon dioxide CO, appear.

Test for oil: Mix a small quantity of sample oil with the dil. HNO_3 in a small bottle. Note down the colour change if any.

What happens:



Water + Chilli Powder

Turmeric+ Conc.HCl Hydrochloric acid

Sugar + Dil.HCl Hydrochloric acid

Oil + HNO_3 Nitric Acid

Chemistry Around...

1: Pure chilli powder will stain the water. The impurities will float on the water or sink at the bottom shedding its borrowed colour.

2: Yellow colour of turmeric will change to magenta if yellow oxides of lead are mixed with turmeric.

3: Brisk bubbles of CO_2 will confirm the presence of washing soda as an adulterant in sugar.

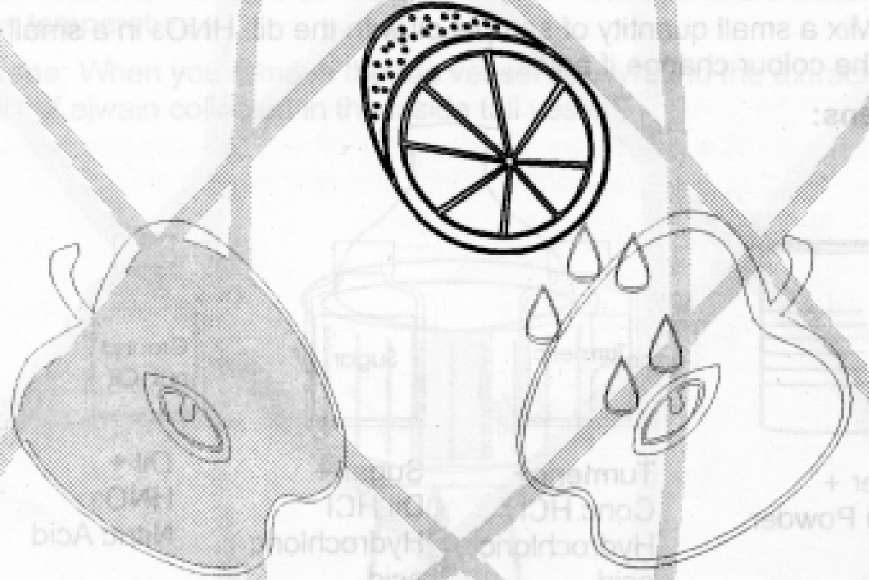
4:Formation of red colour in the acid layer can indicate the presence of argemone oil as an adulterant. This oil can cause swelling in the limbs or pain in the eyes.

Brown Apples...

You need: An apple and a lemon.

What to do: Take one apple and cut it in two halves. Take the juice of one large lemon and pour it over one of the halves of an apple. Leave both the apple halves exposed to air for four hours.

What happens: The part which was covered with lemon juice still remains white but the other part has turned brown. It also shows some change in the taste.



Chemistry Around...

Apples contain enzymes that cause browning of its surface when it is exposed to air. It is due to the enzymes getting oxidised (combine with oxygen). The half with the lemon juice remains white because lemon juice acts as an antioxidant or reducing agent (removes oxygen). It readily oxidises itself and prevents other chemicals in the fruit from oxidation.

We often add lemon juice to the salads which contain fruits. The lemon juice keeps the colour and the taste of the fruits intact and 'fresh'.

Food Preservation...

You need: Some ripe tomatoes, fresh fenugreek (*methi in Hindi, mendhiyam in Tamil, Trigonella foenum graecum)* leaves, raw mangoes

What to do: Separate fenugreek leaves from the stem. Spread in a plate. Keep the plate in the hot sun till the fenugreek leaves turn totally dry.

Slice the raw mangoes. Spread them in a plate and keep in the hot sun till they dry.

Boil the tomatoes in water. Mash them to a pulp. Add a pinch of salt, and a tablespoon of vinegar. Keep the mixture on the stove. Bring it to boil. Keep stirring till the mixture thickens. Add 0.5 gm (approx. one pinch) of potassium bisulphite to it. Fill in an airtight glass jar.

What happens: Now all these three things can be stored to be used later.

Chemistry Around...

This process of food preservation is directly copied from the nature. Grains are preserved by natural drying during ripening. Microorganisms which spoil the food often need free water to grow and multiply. This water content from the food can be reduced by drying in the sun or by heating the food. This stops the microorganisms from growing. The low moisture left in the food preserves its taste.

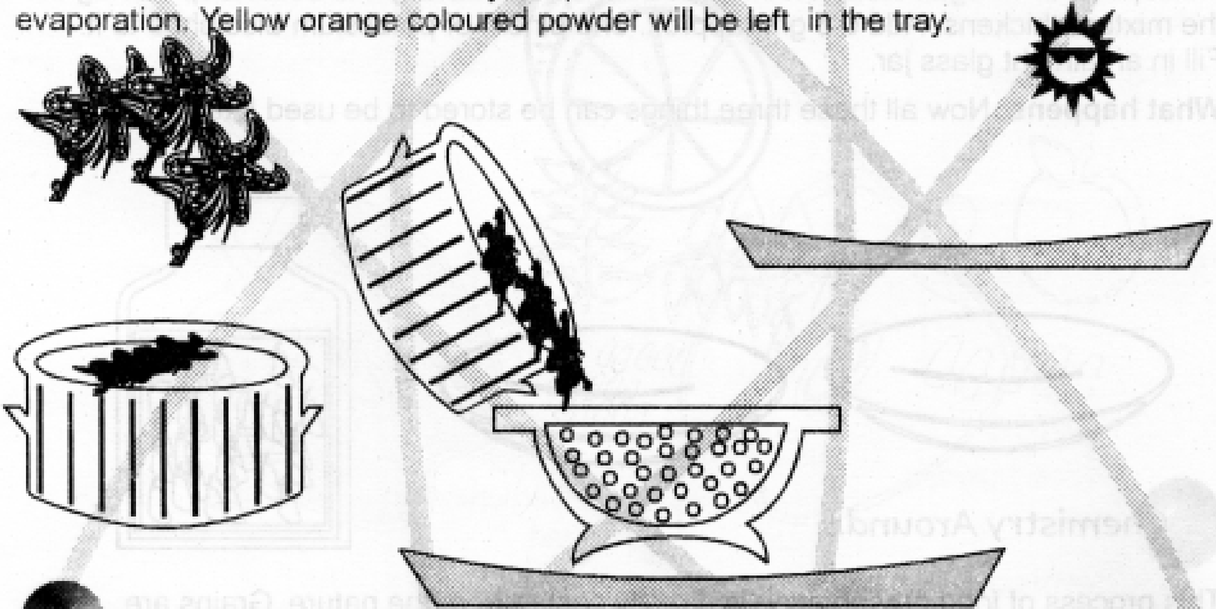
Whenever chemical preservatives are added to the food, they oxidise and form a protective layer on the surface of the food preventing it from getting in touch with the air.

Holi Hai...

You need: Kesuda or flame of forest flower (also *palas* in several Indian languages, *Butea monosperma*), water, bucket.

What to do: Fill the bucket to half of its capacity with water. Dip the Kesuda flowers in it. Leave it overnight. Next day stir the water well with a stick. Then strain it with a thin cloth.

What happens: The cloth used for straining the coloured water takes up some colour. Pour the solution in flat trays or plates and leave them in the sun for evaporation. Yellow orange coloured powder will be left in the tray.



Chemistry Around...

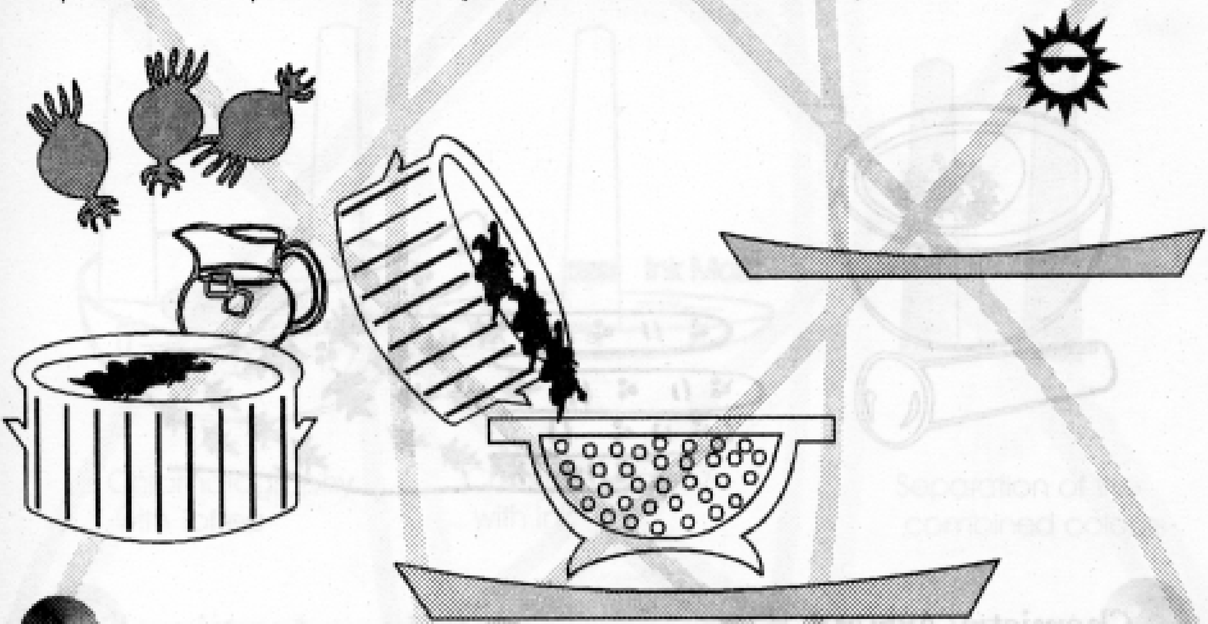
Some natural elements have colouring matters called pigments inside them. This is the simplest way of isolating or removing such pigments from them. These coloured pigments can be used to give colour to the cloth or paintings. The colour made from Kesuda flowers is often used in Holi festival.

Fruits Full of Colour...

You need: Beetroot, water, bucket, strainer cloth

What to do: Fill the bucket to half its capacity with water. Grate the beetroot. Mix them with the water. Boil this water. Leave it over night. Next day stir the water well with a stick. Then strain it with a thin cloth.

What happens: The cloth used for straining the coloured water takes up some colour. Pour the solution in flat trays or plates and leave them in the sun for evaporation. Deep red coloured powder will be left in the tray.



Chemistry Around...

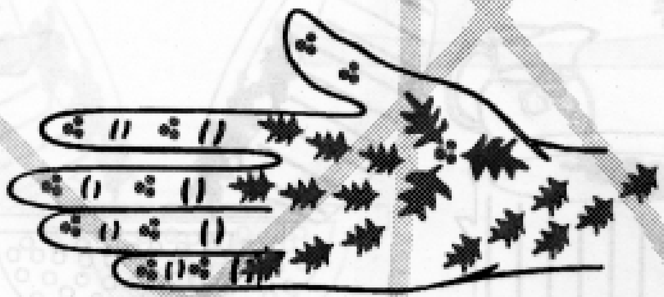
Some fruits have colouring matters called pigments inside them. Beetroot is such a fruit. If the beetroot is grated and sun-dried, it can be used after some time as colouring matter. This is the simplest way of isolating or removing such pigments from them. These coloured pigments can be used to give colour to cloth or paintings.

Colour on My Hand...

You need: Henna - *Lawsonia inermis* - mehndi leaves or powder, water, bucket.

What to do: If henna leaves are fresh, then pour some water over them and grind them well with a grinding stone. This will make a nice even paste of henna. If the leaves are in powder, make paste by mixing it with water. This paste looks greenish black in colour. This paste can be applied on your palms, or paper or cloth. Make an interesting design and wait till the paste dries. Then wash off the paste with water.

What happens: Though the paste was dark green, the colour of the design on the palm is deep orange. This will be seen on palm as well as on paper. If you have coloured the cloth with henna, it will be dyed orange.



Chemistry Around...

Henna leaves contain orange coloured pigments in them along with green chlorophyll. This pigment gets activated only when it is mixed with water and applied on cellulose such as skin, hair, paper, cloth, etc. "The dyeing process is a chemical property of a brown tannin-like resinoid fracture substance that is called hennotannic acid."

Chromatography...

You need: Red or brown coloured sugar toffee (confectionery), bowl, white chalks.

What to do: Fill the bowl till one fourth with water. Place one unwrapped sugar toffee in it. The toffee should be coloured. Stand one chalk in the bowl carefully. It should not topple. Leave it there for sometime.

What happens: After some time you will see interesting colour patterns on the chalk. Different colours will rise up to different height on the chalk along with water.

Chromatography with Toffee

Chromatography with Ink

Separation of the combined colours

Chemistry Around...

The food colour used in the toffee can be made from combination of colours. These different colours rise to the different height according to their chemical structure. This colour separations can be with the different inks too. Place a drop of ink at the bottom of the chalk and stand it in the water. You can see the separation of colours. This process is called Chromatography.

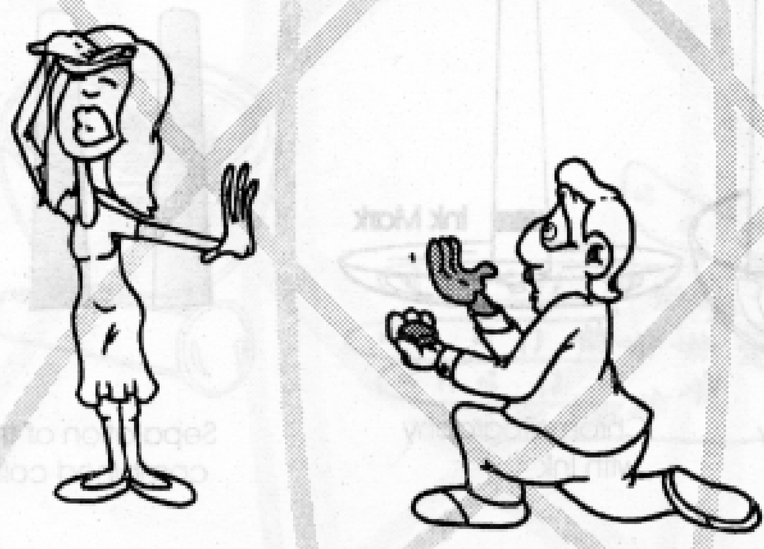
Fake Blood...

You need: Ferric chloride $FeCl_3$, sodium thiosulphate $Na_2S_2O_3.5H_2O$, cardboard face.

What to do: Dissolve ferric chloride crystals in some water. Paint the cardboard face with this liquid. Dissolve sodium thiosulphate crystals in water. Take some of this solution on your hand. Slap the cardboard face hard. Slap again!!

What happens: The cardboard face will start bleeding where ever you slap it.

If you like you can try this variation. Paint one of your palms with ferric chloride and another with sodium thiosulphate. If you want to impress your friends, rub both palms together. You will see red colouring on your hand. Be careful not to put your hands in your mouth. After the show immediately wash your hands with soap and water.



Chemistry Around...

A reaction takes place between ferric chloride, FeCl3, and sodium thiosulphate giving red colour precipitate(solid substance). The red colour gives the impression of blood on the hand. This reaction is often used to mislead people by magicians.

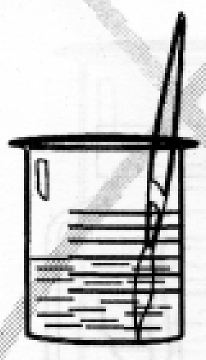
Letters on the Fire...

You need: A card box lid, concentrated potassium nitrate solution (KNO_3).

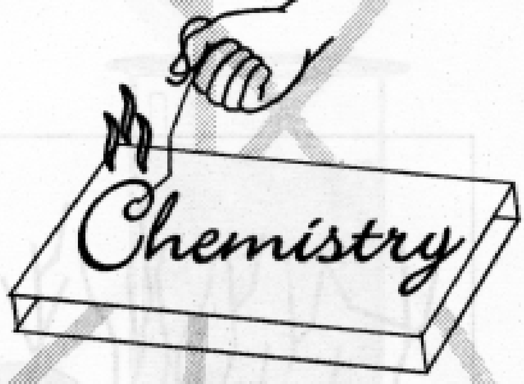
What to do: Place the card box lid on the table. Place it on the table in such a away that the writing side is on the height from the table. Take a strong potassium nitrate (KNO_3) solution. This solution is going to be our ink for writing a name or drawing a picture. Use a paint-brush to draw this picture on top of the card box lid. Allow the paper on the card box to dry.

Now take a twine (thick thread). Set it on fire. Then blow the fire out and allow the tip of the twine string to smoulder. Touch the end of your picture with this smouldering string as shown in illustration.

What happens: The card paper burns along the course of the ink line . You will see the invisible picture or letters set on fire but the rest of the paper will remain unharmed.



Write with conc. KNO_3



Touch with smouldering twine

Chemistry Around...

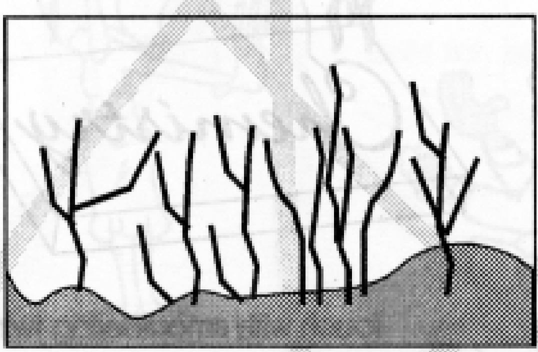
Potassium nitrate (KNO_3) burns with bright light at a lower temperature. The paper requires higher temperature to burn. Burning of potassium nitrate (KNO_3) does not affect the paper. That is why we see only the letters burning.

Chemical Garden...

You need: Sodium silicate, glass jar, sand, coloured stones and sea shells , salts of metals like copper chloride, copper nitrate, cobalt chloride, cobalt nitrate, aluminum sulphate, ferrous sulphate and ferric chloride, nickel sulphate and alum.

What to do: Place sand on the floor of the glass jar. Arrange some decorative stones. Take sodium silicate in a beaker. Add lukewarm water to it in equal ratio. When sodium silicate is homogeneous with water, transfer it to the glass jar. Also add crystals of all the above mentioned salts you can get. Leave the jar undisturbed for a day.

What happens: The crystals of various salts grow like plants making tree like structures. These structures are very attractive in colours and shapes.



Chemistry Around...

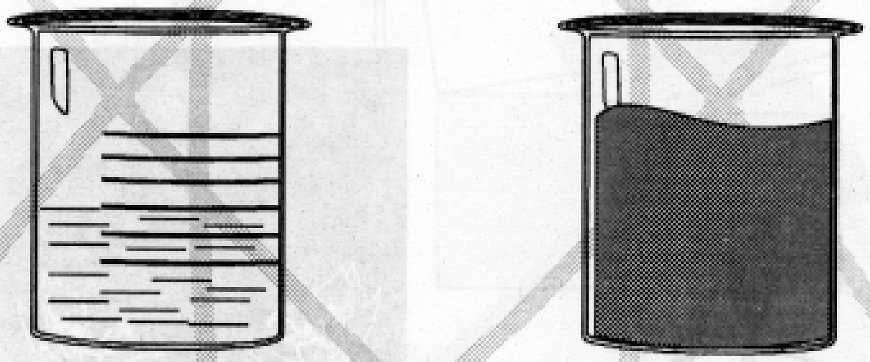
The different salts of metals grow different coloured crystals. Ferric chloride ($FeCl_3$) crystals grow brown branches. Copper and nickel sulphate ($CuSO_4$, $NiSO_4$) give blue green growths. The crystals grow colourfully in various shapes.
Addition of sodium silicate thickens the liquid arresting the dissolution of salt crystals. The salt crystals grow in the thick mass to attractive plant like shapes.

Black Pillar...

You need: Powdered sugar, water, concentrated sulphuric acid H_2SO_4, beaker.

What to do: Take four to five spoons of powdered sugar in a beaker. Add about 10 ml of water to it and stir. Now add 10 ml of concentrated H_2SO_4 to it. Stir it with glass rod. Observe.

What happens: After some time a black coloured pillar will rise in a beaker. The pillar will keep rising for some time. Do not touch the beaker till it gets cooled completely.



Sugar + Water + H_2SO_4

Sulphuric acid

Black Pillar Rising

Chemistry Around...

Sulphuric acid burns the sugar and turns it in to charcoal

$$\underset{\text{Sugar}}{C_{12}H_{22}O_{11}} + \text{conc. } H_2SO_4 \longrightarrow \underset{\text{Carbon}}{12C} + 11H_2O.$$

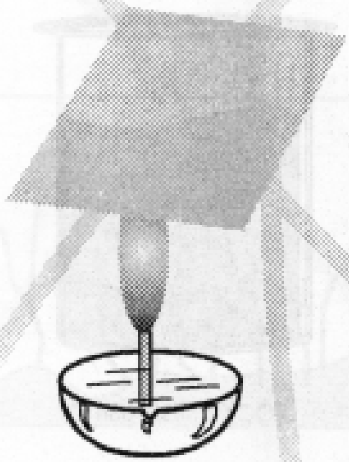
Designer Showpiece...

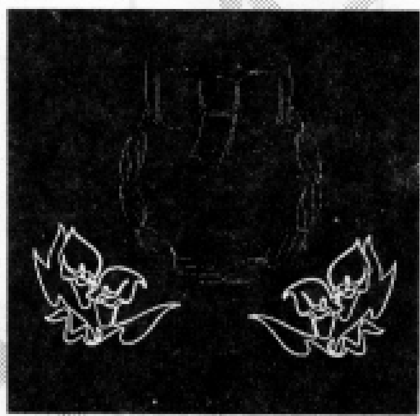
You need: Earthen lamp, turpentine oil, cotton, sheet of glass, aluminum foil.

What to do: Perform this activity outdoors. The black soot released from the turpentine lamp can darken the walls of your home.

Fill turpentine oil in the earthen lamp. Make a wick out of cotton and place it in the lamp. Light the lamp. Hold the glass sheet horizontally over the wick about 5 inches away.

What happens: The carbon soot will blacken one side of glass sheet evenly. Draw a picture on it with some sharp object taking away the soot. Ear cleaner bud or cotton covered matchstick can also be used to draw and remove the soot. Hold this glass sheet against light. You can also cover the backside of the sheet with shining aluminum foil. This makes a great looking wall hanging.





Chemistry Around...

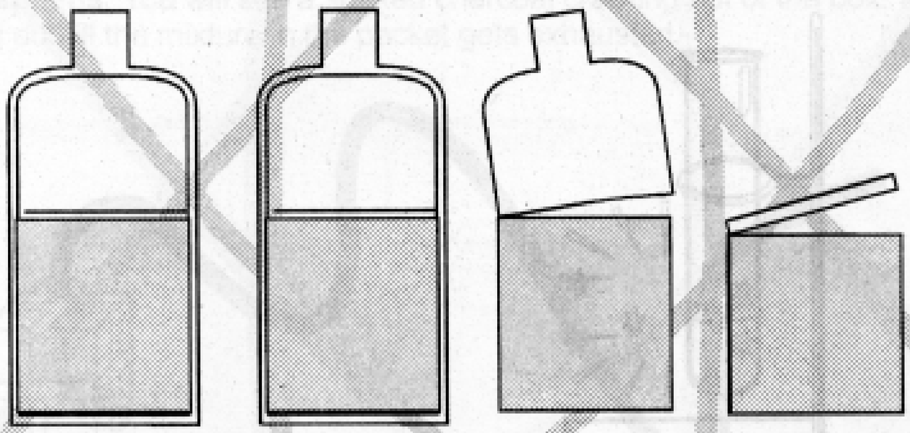
What we collected on the glass sheet was lamp black or soot. When a carbon compound is burned we get small particles of carbon which is called soot. This soot is used in preparing inks, for printing, making carbon paper and black shoe polish. If carbon soot is dissolved in few drops of methyl alcohol and mixed with little amount of vaseline will make shoe polish.

Ink is formulated by mixing soot in different solvents giving fast drying quality and colour intensity.

Glass Rings...

You need: Glass bottle, turpentine oil, twine thread, water, candle.

What to do: This method is used to make beautiful glass rings from old glass bottles. Fill the bottle with water to the level where it has to be cut. Dip the thread in turpentine oil. Tie this thread on the bottle tightly at the mark of the water level. Burn the thread with help of a candle.
What happens: The bottle is cut at the edge of the thread. Carefully separate the cut portion of the glass bottle. Similarly the rest of the bottle can be cut into decorative rings.



Chemistry Around...

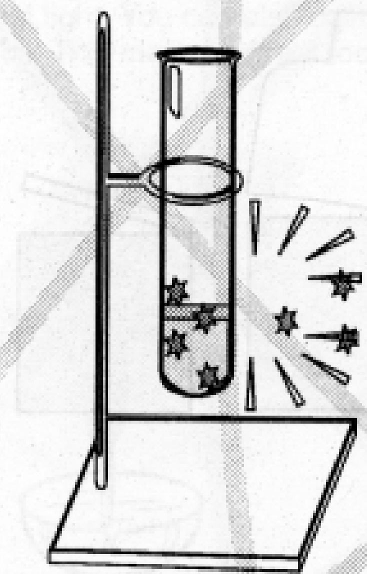
The burning of the thread raises the temperature of the glass surface. The water in the bottle keeps the surface cool. The hot surface tries to expand and cool surface offers resistance for expansion. This impact of sudden temperature difference on the surface cuts the glass of the bottle. This glass is cut on the mark made by the thread. Beautiful crafty glass rings can be obtained if this experiment is done carefully.

Crackers in the Bottle...

You need: Concentrated H_2SO_4, methanol, potassium permanganate $KMnO_4$, glass test tube.

What to do: Take 2 ml of concentrated sulphuric acid in the test tube. Fix the test tube on the test tube stand or hold it with test tube holder away from your body. Add 2 ml of methanol from the sides of the test tube very slowly. Slow addition stops the two liquids from immediately mixing with each other. Add crystals of $KMnO_4$ in this test tube.

What happens: You will see small explosions taking place inside the test tube every time you add new crystals of potassium permanganate.



Chemistry Around...

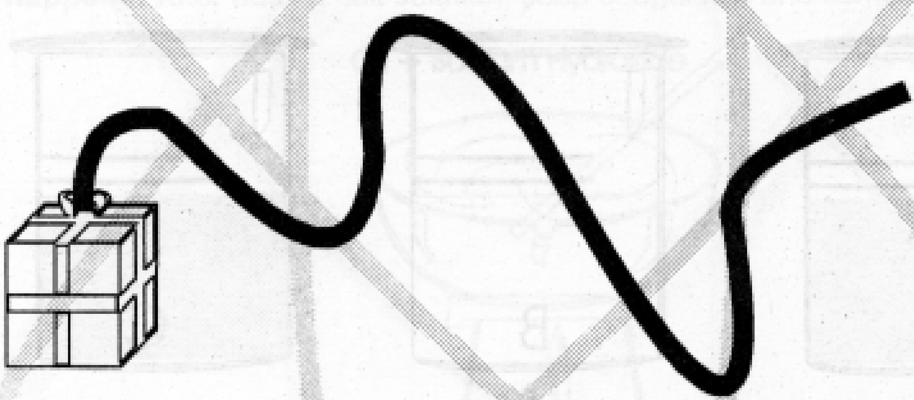
Addition of potassium permanganate ($KMnO_4$) results in oxidation (combines with oxygen) of methanol. This reaction is exothermic. Some amount of heat is given out in an exothermic reaction. Small explosions or sparks occur in sulphuric acid (H_2SO_4) due to this evolved heat.

Black Cobra...

You need: Ordinary sugar, potassium nitrate, potassium bichromate. All the three substances should be ground into fine powder separately.

What to do: Take 4 gm of potassium nitrate, 10 gm of potassium bichromate and 10 gm of sugar. Mix it well with help of a plastic spoon. Take a little portion of this mixture on a piece of paper. Fold the paper well and secure the mixture inside it. Put this paper packet in a small cardboard box or empty matchbox. Place this cracker on the ground, keep a safe distance and ignite it.

What happens: You will see a snaked charcoal crawling out of the box. It will keep crawling out till the mixture in the packet gets exhausted.



Chemistry Around...

Reaction between potassium nitrate (KNO_3)and potassium bisulphate (K_2SO_4) produces tremendous heat, charring the sugar. It comes out as charcoal 'snake'.

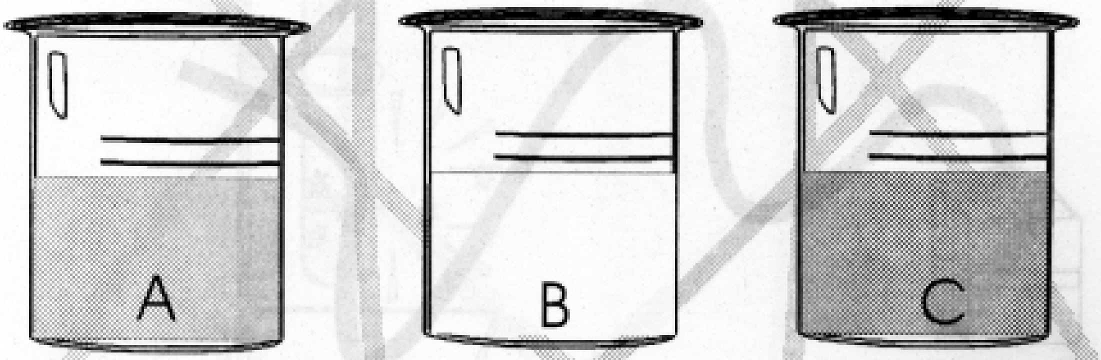
Wash your hands thoroughly after preparing this cracker as well as after playing with it. Do not leave the cracker powder exposed as chemicals are used for this reaction.

Patriotic Chemicals...

You need: Liquid ammonia in a large glass jar, phenolphthalein, lead nitrate [$Pb(NO_3)_2$], copper sulphate ($CuSO_4$), three 100 ml beakers, water

What to do: Mark the three 100 ml beakers as A, B, and C.
Add 1 ml phenolphthalein solution to beaker A.
Take 50 ml solution of lead nitrate in Beaker B (1 gm $Pb(NO_3)_2$ in 50 ml water)
Take 50 ml copper sulphate solution in Beaker C (1gm $CuSO_4$ in 50 ml water)
Now add about 25 ml of liquid ammonia solution to each of the above three beakers.

What happens: You will see Beaker A showing bright red coloration.
Beaker B showing white colouration and beaker C showing deep blue green colouration.



Add Phenolphthalein   Add Lead Nitrate   Add Copper Sulphate

Chemistry Around...

Liquid ammonia is an alkali. It reacts in different ways with different chemicals giving specific colourations. To get colours similar to the Indian flag, we add phenolphthalein in beaker A. It gives red colour in beaker A. When lead nitrate is added in beaker B, a reaction takes place and the beaker shows white precipitation. When copper sulphate is added in beaker C, the chemical reaction results in deep blue green colour.

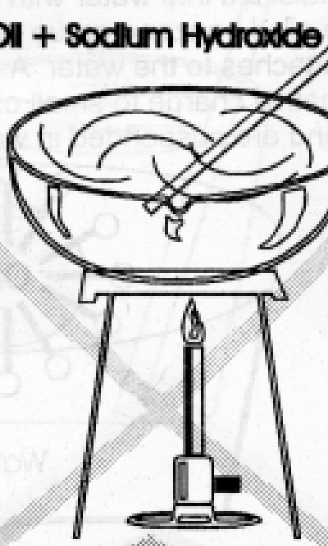
Homemade Soap...

You need: Ordinary cooking oil, sodium hydroxide ($NaOH$), sodium chloride, $NaCl$ (table salt)

What to do: Take 10 ml of cooking oil in a steel (do not take aluminum pan as it will be spoiled by caustic) pan. Heat the pan till approx. 70 degree centigrade (medium flame). Add 10 ml of sodium hydroxide ($NaOH$) solution to it with constant stirring. Continue to heat this solution till the solution thickens. Then add 20 ml of water to the pan to get a uniform solution. Cool the solution and then add 100 ml of saturated sodium chloride solution with stirring. Separate the soap which is formed. Squeeze it and place it in a mould to give it a suitable shape.

What happens: After adding salt solution, soap coagulates and comes on top.

Oil + Sodium Hydroxide



Chemistry Around...

Sodium hydroxide reacts with oil to give it oil capacity to absorb water. This process is called saponification. The ability to absorb water as well as oil makes soap a good cleanser. When the soap so formed comes together, it is called coagulation.

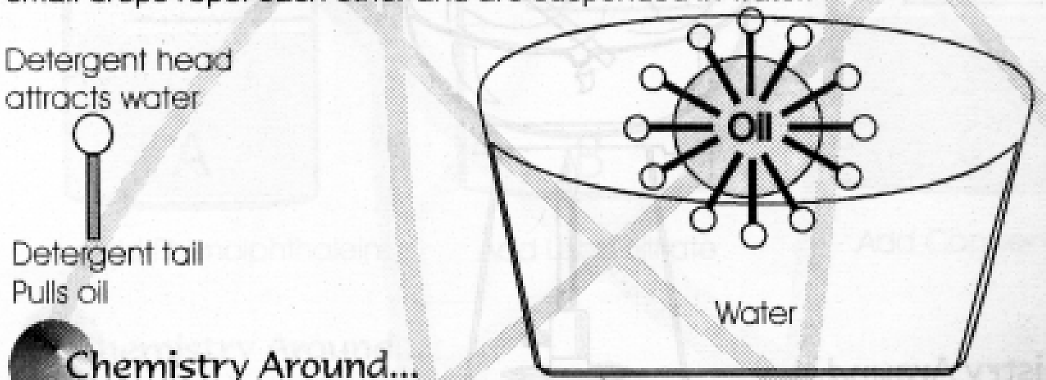
Synthetic Detergent...

You need: Sodium hydroxide (caustic soda or NaOH), acid slurry (linear alkyl (benzene sulphonate), Thickener powder carboxy methyl cellulose also known as (CMC), soda ash (sodium carbonate)

All the above items are available in general grocery stores.

What to do: Take one litre acid slurry in a plastic bucket. Do not use aluminum or metal bucket. Add the sodium hydroxide powder (50 gms) to it with constant stirring. Use a long wooden rod for stirring as acid slurry may give out fumes. Add one kilogram sodium carbonate powder to it. And one kilogram CMC powder to stabilise the detergent. Let the powder be completely dry.

What happens: In the above procedure sodium salt of linear alkyl benzene is formed. Ionised sulphonic acid group gives water solubility and alkyl benzene gives solubility in oil. During washing process, oily substances from body or machine parts containing dirt particles get emulsified into water with the help of above detergent. In the emulsification process, the alkyl benzene group attaches to the oil part and ionised sulphonic acid group attaches to the water. A number of such arrangements of different molecules give negative charge to small oil drops. Because of this charge small drops repel each other and are suspended in water.



Chemistry Around...

A detergent is a substance which has a head and a long tail. The head part gives affinity towards water and tail part gives affinity towards oil. Detergents do not precipitate in hard water due to presence of high concentration of salts. That is why detergents provide better solubility and good foaming capacity in water.

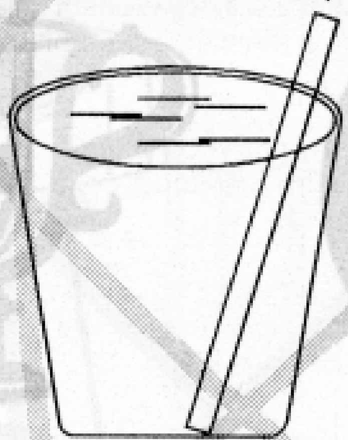
*****__The materials required for preparing detergents are available at industrial chemical shops. The kit is available with Shishu Milap.__**

Liquid Cleaners...

Y ou need: Acid slurry (linear alkyl benzene), sodium hydroxide NaOH, soda ash (sodium carbonate), urea, CMC(carboxy methyl cellulose) powder.

What to do: Take one litre acid slurry in a plastic bucket. Do not use aluminum or metal bucket. Add 50 gm Sodium hydroxide to it. Add two liters of water to it with constant stirring. Use a wooden rod for stirring. Also add 100 gm thickener powder and 50 gm urea powder to it. Stir till a uniform solution is obtained. Add few drops of perfume to the liquid detergent for a pleasing smell and appearance.

What happens: The liquid soap is ready. This liquid dish washer solution ensures action on the oils and the foods are separated from plates. Addition of urea does not allow the oil to get redeposited on the vessels or plates.



Chemistry Around...

Take 10 ml of the liquid soap in a test tube. Place a thumb on the test tube and shake it. Greater the height to which foam rises, greater is the foaming capacity. Liquid soap is a detergent. It softens the water so it gives good foam which is useful in cleaning oily utensils.

Clay Designs...

You need: Ceramic clay, lime powder, zinc oxide, white adhesive ('Fevicol'), earthen plate.

What to do: Mix ceramic clay and lime powder in equal proportion. Add one tablespoonful zinc oxide powder to it. Add adhesive liquid to it and knead it to a soft dough. Make sure the dough is very soft and even. Now take small portions of this dough and shape them into different shapes of flowers, leaves or ropes. Stick all these shapes with gum on the earthen pot or plate. Leave it in the shadow for drying.

What happens: The designs on the pot or plate will dry out . There will be hard white coloured shining murals on the pot.

Chemistry Around...

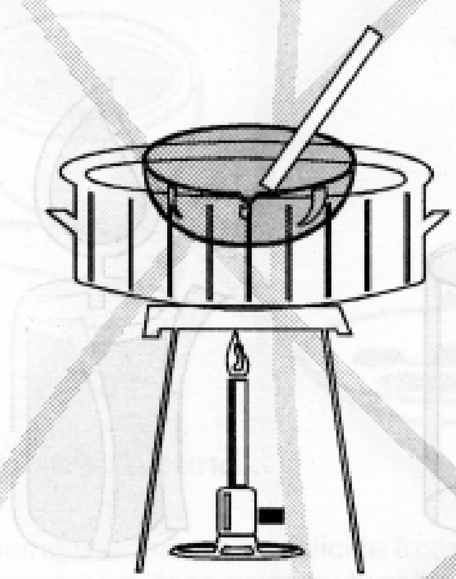
Ceramic clay usually requires firing in the oven to harden and get strength. Lime powder is added to it so it helps the ceramic design to remain firm in shape. Various oxides are added to ceramic clay to get different colours. Here zinc oxide provides the bright white colouring. Adhesive holds the clay and lime powder together and sticks them on to the pot.

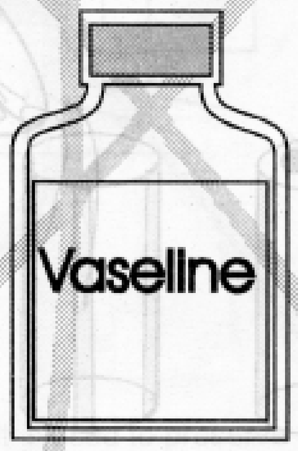
Skin Softeners...

You need: Paraffin wax, liquid paraffin, perfume.

What to do: Heat paraffin and paraffin wax together in water bath. Place a large vessel filled with water on the burner. In this water bath keep a vessel filled with paraffin for heating. This will avoid direct contact of paraffin with fire and high temperature as paraffin is a highly volatile substance. Once paraffin melts, remove it from the burner and add few drops of perfume to it. Keep stirring the solution till it thickens.

What happens: The paraffin solidifies as it cools. The substance formed has a semi liquid or semi solid state. This is Vaseline or petroleum jelly.





Chemistry Around...

At room temperature, liquid paraffin exists in liquid state and paraffin wax exists in solid state. They mix well while they are both liquids. Their physical properties make them exist together in a paste or cream form.

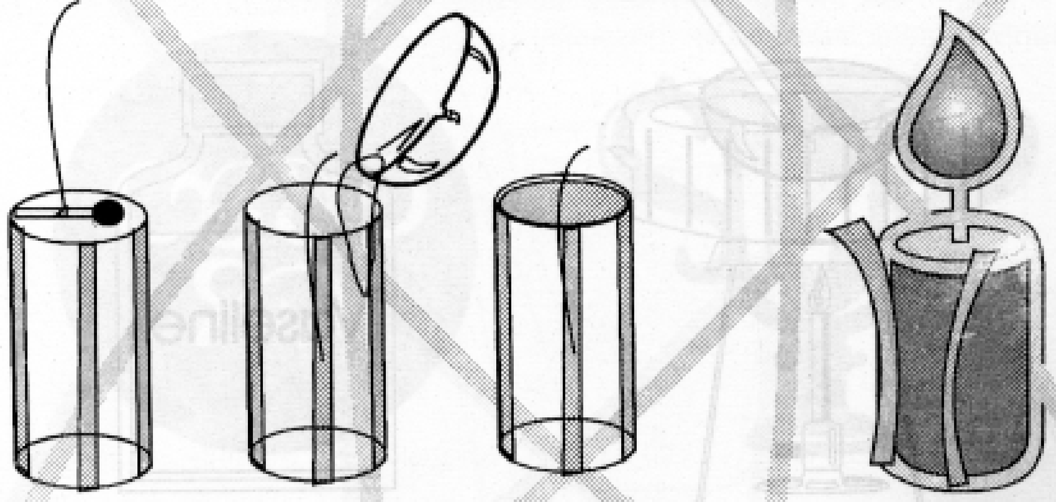
Candles...

You need: Paraffin wax, stearic acid crystals, burner, cardboard box, oil, oil pastels.

What to do: Heat one kilogram of Paraffin wax in a pan over a very low flame. The wax melts. Add a pinch of stearic acid to it. Stir a little.

Grease the cardboard box with oil. Tie one end of tread to the matchstick. Place the matchstick in the card box and pour a little wax over it. Let it cool. This is to fix the wick of the candle. Now pour the melted wax in the box. Leave it to set.

What happens: After several hours, the wax will cool and solidify. Now tear away the cardboard mould and the candle is ready.



Pour wax in card box

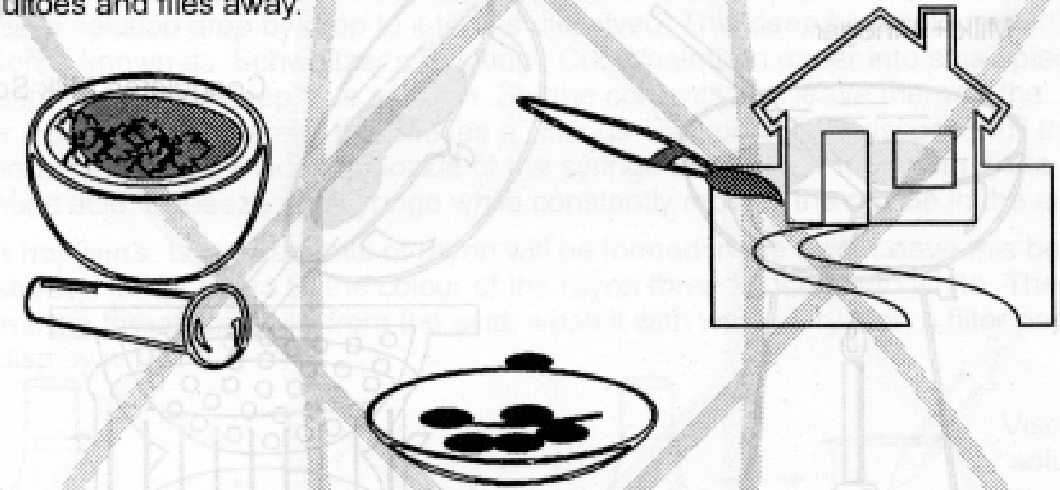
Tear away the card box

Chemistry Around...

The candle wax burns for a longer time after addition of stearic acid. The melting point of wax is increased with the addition of impurity. So the candle's life is increased.

Neem Pesticide...

You Need: Neem tree leaves, orange rinds, mortar and pestle, table salt, water.
What to do: Take neem leaves and orange rind in mortar. Grind it well with pestle. Grinding can also be done with help of stones. Mix them well to make consistent a paste. Make lines of this paste with a brush on areas prone to be attacked with ants. Add a spoonful of salt to the mixture. Keep the mixture for drying in the sun. When it is slightly wet, make oval shaped balls. These balls can be ignited directly or with coal.
What happens: The paste of neem leaves can repel ants and other insects like mosquitoes and flies away.



Chemistry Around...

Neem is being used as an insecticide from olden times. It is used to preserve grains, used to keep mosquitoes away by burning it in bonfires, and used in oils to keep lice away. It is a biodegradable insecticide.
Biodegradable insecticides have a substance called Malathion or Parathion. (an organophosphate group). They also contain nitrogen.

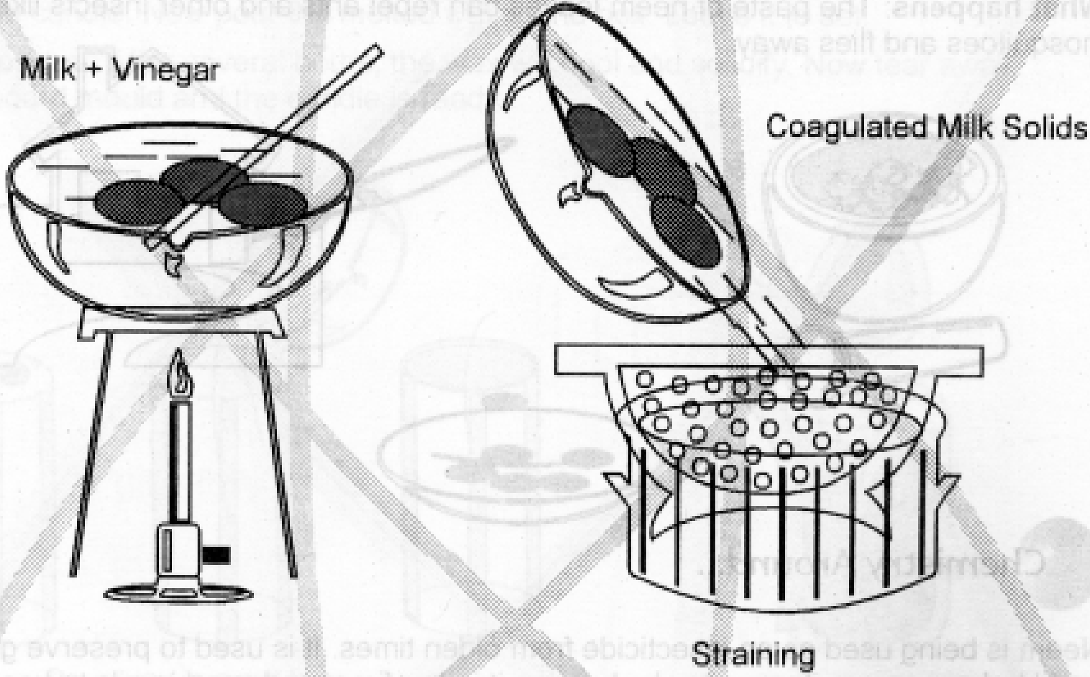
The above mixture can be boiled in alcohol, treated with sodium metal and then tested with solid ferrous sulphate, ferric chloride and dilute H_2SO_4. Te blue precipitate or blue-green colouration indicates the presence of Nitrogen.
This reaction can be performed by those who wish to submit a science project showing presence of nitrogen in the pesticides.

Homemade Plastic...

You need: Milk, vinegar, burner.

What to do: Take a cupful of milk in a container. Add vinegar to it in equal amount. Place the mixture on a burner. Bring it to boil.

What happens: Solids in the milk will come together in the center or coagulate. Separate them by straining. This elastic substance can be put into any mould. This milk polymer will be elastic in wet condition. It will harden as it dries.



Chemistry Around...

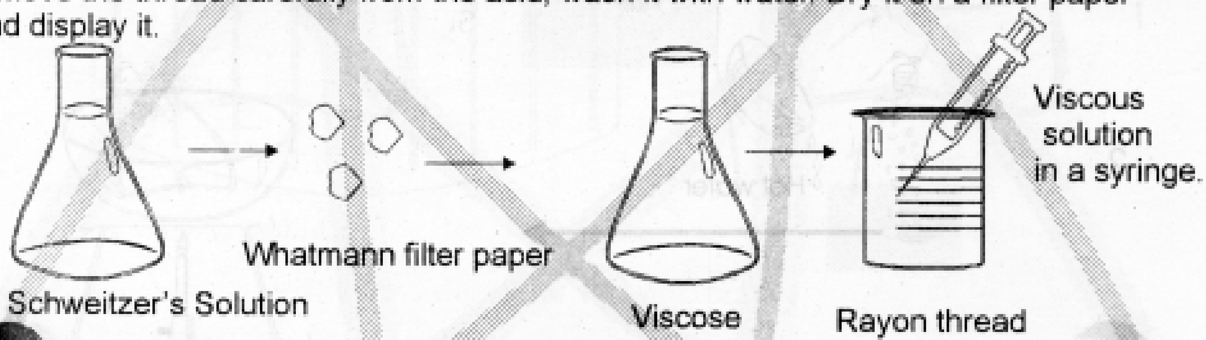
The coagulated substance is like a polymer. It acquires similar plastic-like qualities when it hardens.

Artificial Silk...

You need : Copper sulphate $CuSO_4$ (10 gm) sodium hydroxide NaOH, 50% ammonia solution NH_3, dilute sulphuric acid H_2SO_4, Whatmann filter paper.

What to do: Take 10 gm of copper sulphate ($CuSO_4$) in a beaker and add water to it in small quantity to form a saturated solution. Stir the contents at the same time. Add to it dilute solution of sodium hydroxide (NaOH) drop by drop. Copper hydroxide ($Cu(OH)_2$) will precipitate. Add sodium hydroxide (NaOH) solution till Cu (OH)2 precipitation is complete. Filter the precipitate and wash it by pouring water over it 3 to 4 times. Transfer the blue coloured precipitate to a conical flask and add 50% ammonia solution drop by drop to it till it is dissolved. This deep blue coloured solution is known as 'Schweitzer's Solution'. Cut Whatmann paper into small pieces and add them in the deep blue solution. Stir the contents and leave them till the paper dissolves completely. This makes a viscous solution called 'viscose'. Fill this solution in a syringe. Place the nozzle of the syringe in a beaker filled with dilute sulphuric acid. Squeeze the syringe while constantly moving the nozzle in the acid.

What happens: Long filaments of rayon will be formed in the acid. Leave this beaker undisturbed for 24 hours till the colour of the rayon thread changes to white. Then remove the thread carefully from the acid, wash it with water. Dry it on a filter paper and display it.



Chemistry Around...

Viscose fabric is obtained from rayon threads. The rayon thread is obtained by dissolving cellulose (filter paper in this case) in tetra-amine cupric hydroxide. This solution was passed through dil. H2SO4 to reprecipitate cellulose to give a thread of tetrammonium rayon. This is also known as cupra silk.

Cu(OH)2 4NH4OH ⟶ [Cu(NH3)4](OH)2 + 4H2O
Blue Precipitate

Cu(NH3)4](OH)2 $\xrightarrow{\text{Add Filter Paper}}$ A Viscous solution. ⟶ Rayon thread
Blue Precipitate

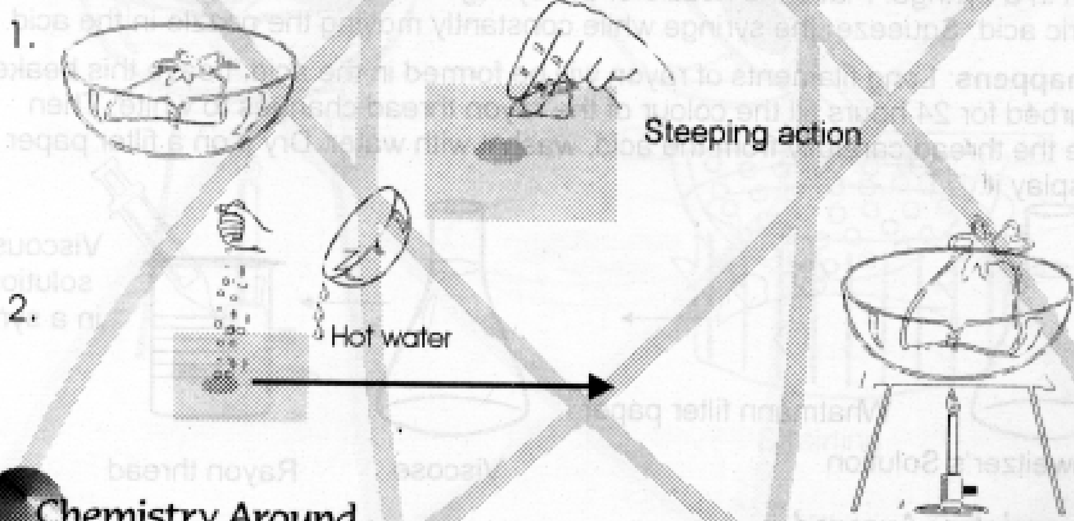
Coffee Spills and Tea Stains...

You need: Glycerine, cotton cloth stained with coffee. Borax, water, brush, detergent powder, nylon cloth sample with stains of tea, shallow tub.

What to do: For coffee stains - Take glycerine in a shallow tub just enough to dip the cloth sample. Steep (soak) the cloth in glycerine until the stain is removed. For steeping, take some cotton wool. Dip it in glycerine. Wipe the spot repeatedly with the cotton wool.

For tea stains - Spread borax powder and rub it over the tea stain on the nylon cloth. Pour boiling water over the stain. Collect the water in the tub underneath. Dip the cloth in the same water for about 30 minutes. Take out and wash with detergent in cold water.This procedure works only for removing stains on the nylon cloth.

What happens: It takes about 30 minutes of steeping time for the coffee stain to be removed completely. The tea stains are removed almost immediately.



Chemistry Around...

Glycerine is mild on cotton fibers and does not dissolve the cloth fiber even as it removes the coffee stain.

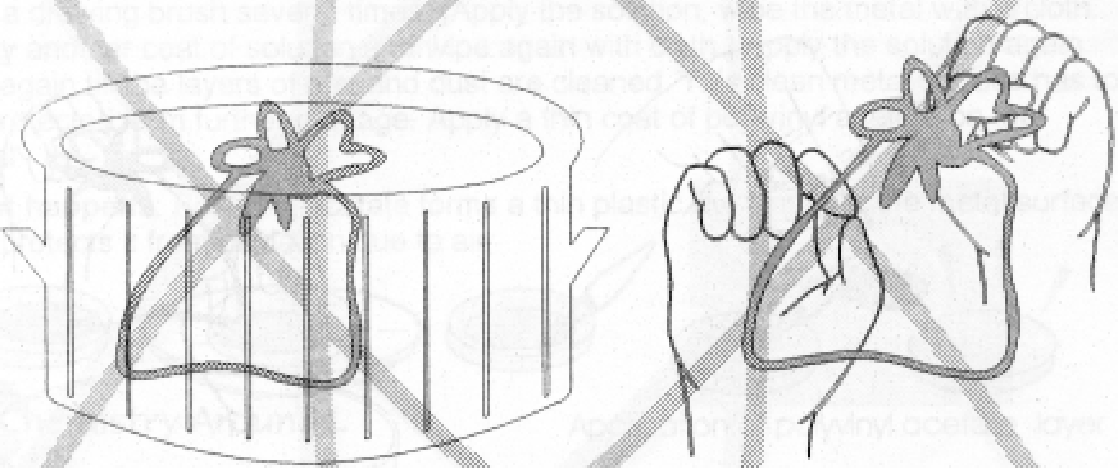
Staining pigments of tea are dissolved in borax without harming the nylon fibers. While choosing an effective stain remover, the fabric structure has to be taken in to consideration. A chemical is chosen which can dissolve the staining pigment but does not affect the cloth. Grass stains can be removed by the same procedure as that of coffee stains.

Wash my Dirty Linen...

You need: Cloth samples stained with blood, egg and curry, salt, detergent.

What to do: Dissolve 100 gm of salt in 4 litres of water. Dip the stained cloth in it and leave it there for 30 minutes. Keep rubbing the cloth with your hands in between. Take out and wash with detergent and cold water.

What happens: The stains of egg are removed completely. Blood stains wash away almost and curry stains are reduced considerably.



Chemistry Around...

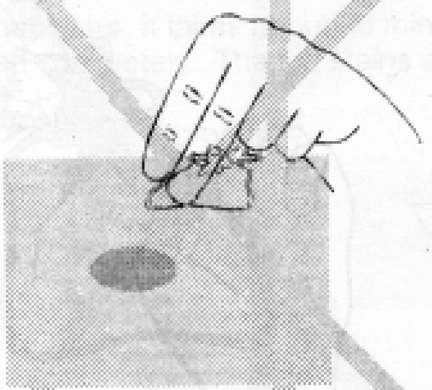
The curry stains can go deep in the weaving structure of cloth. A suitable enzyme is required to dissolve them without disturbing the fibre structure.

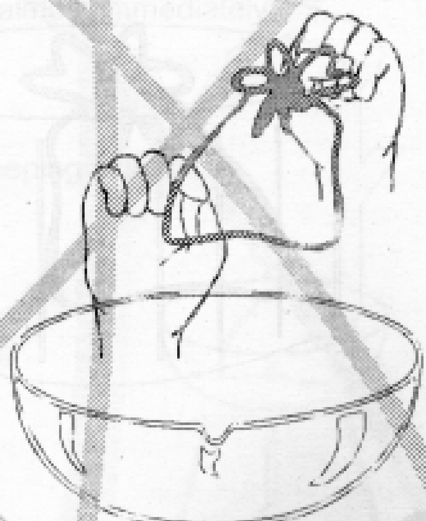
Schooltime Blues...

You need Blended cloth sample stained with printing ink or ball point ink, methylated spirit, detergent powder.

What to do: Dab the stained area with methylated spirit. Repeat after 10 minutes. Do the same three times. Wash the cloth with detergent and cold water.

What happens: The stains fade every time you rub methylated spirit on it. Do not rub unevenly and be careful of not staining the new area while removing the stains.





Chemistry Around...

The ink gets dissolved in the spirit. You may keep a blotting paper below the stained area to blot away immediately the solvent in which the ink is dissolved. This saves the cloth from getting restained.

Conservation of Metals...

You need: Old, rusted metal coins or pieces of copper and zinc metal, sodium hydroxide, sodium potassium tartrate, polyvinyl acetate, plastic hand gloves

What to do: Wear the hand gloves before beginning to clean the metal. Wash the metal with water and dry it with cloth. If copper or zinc metal coin or an artefact is being cleaned, place the metal in solution of 15% sodium carbonate (15 gms of sodium carbonate Na_2CO_3 dissolved in 100 ml of water) for 4 to 5 days. Superficial rusting will be cleaned by this method. If the metal has coats of rust or cement on it then it has to be treated with the solution of Russel's salt. This solution is made by mixing 15 parts sodium potassium tartarate powder (15 gms) and 5 parts of sodium hydroxide (5 gms) in 100 parts of water (100 ml). Apply this solution on the metal with a drawing brush several times. (Apply the solution, wipe the metal with a cloth. Apply another coat of solution and wipe again with cloth.) Apply the solution again and again till the layers of rust and dust are cleaned. This clean metal surface has to be protected from further damage. Apply a thin coat of polyvinyl acetate on the metal.

What happens: Polyvinyl acetate forms a thin plastic like film over the metal surface and protects it from oxidation due to air.

Application of polyvinyl acetate layer

Chemistry Around...

Pure metal is acquired from its ore present in the earth. When exposed to air for long time or if hidden in the earth once again, it combines with other elements and loses its pure form. This process is called rusting. The colour of this rust depends upon the nature of the metal. This rust is removed with suitable chemicals without disturbing the inscriptions on the valuable coins.

If the coin has layers of cement on the surface then it is cleaned with 5% ammonia solution (5 gms of ammonium hydroxide dissolved in 100 ml of water) or 5% citric acid (5 gms of citric acid dissolved in 100 ml of water). A transparent coat of polyvinyl acetate is applied on this metal to prevent further rusting.

All the above chemicals should be handled carefully. The metal rust is very dangerous. All the chemicals used here are of high concentration. They are available with the chemical dealers. The conservation laboratory in your local museum can provide guidance from the experts for maintaining metal artefacts. The basic study of identification of the metal, nature of rust etc. Should be done with their help.

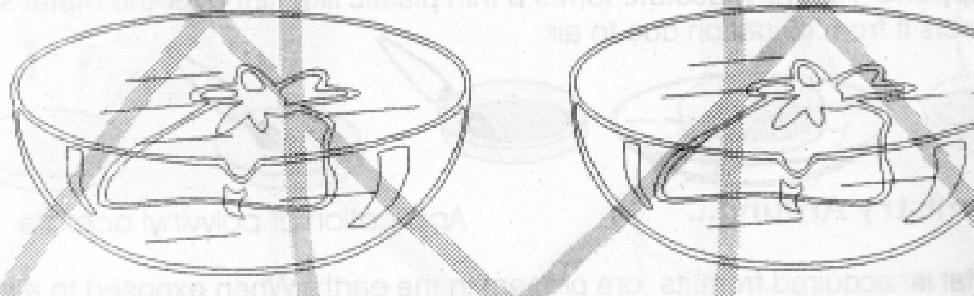
Machine Menace...

You need: Polyester or blended cloth sample with stains of grease or tar. These are oil-based stains. Another cloth with a stain of shoe polish. Turpentine, methyl alcohol.

What to do: Dip the grease stained cloth in methyl alcohol for about 24 hours. Remove and soak in detergent powder for about three hours. Wash the cloth afterwards.

The cloth sample with shoe polish stain is steeped in terpentine for about 5 minutes time as shown in the picture. Place a blotting paper below the stained spot. Dip some cotton in turpentine. Wipe the spot with cotton a number of times.

What happens: The grease stain is completely removed. The shoe polish stain also disappears. Shoe polish dissolves in turpentine which is absorbed by the blotting paper below the cloth.



Methyl alcohol   Terpentine

Chemistry Around...

The pigment in grease gets dissolved in the solvent. The oily part is **saponified** by the detergent making it water soluble. Thus it is washed away during the washing.

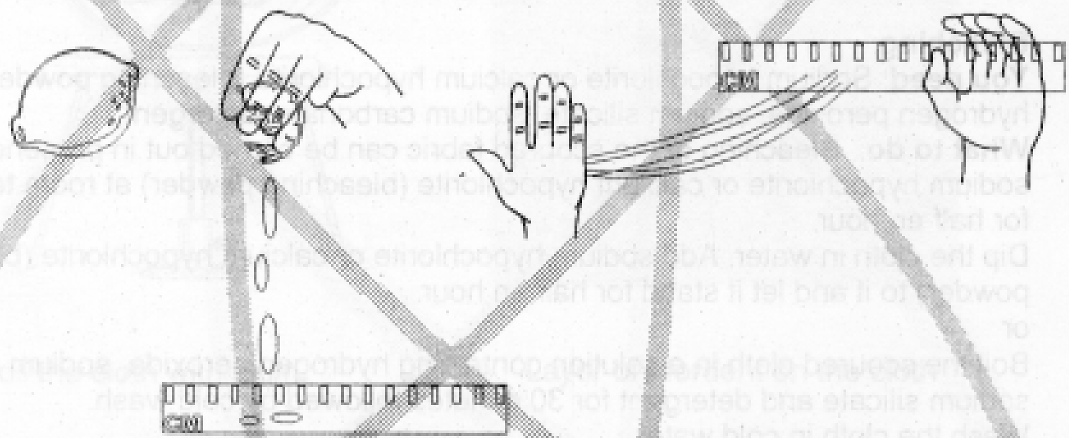
Similarly [redacted] turpentine dissolves shoe polish stains.

Plastic Cloth...

You need: Old plastic compass ruler, fresh orange peels, small paper.

What to do: If you squeeze the fresh orange peels, a certain kind of juice comes out of them. Place a ruler on the table and squeeze an orange peel over it. Wait for 10 seconds and very carefully press the ruler against well supported piece of paper. Now hold the paper tight in place and slowly pull the ruler outward. You will see thin plastic strings of thread pulled along with the ruler. The pulling has to be real slow or else these threads will be broken. Keep on doing it till all the threads together form a cloth-like piece.

What happens: A small piece of cloth will be obtained which will be soft and very thin. Allow this cloth to stabilize, then make an attractive drawing on this plastic cloth with a ball pen. While doing this the surface of the ruler will become rough.



Chemistry Around...

The orange rind contains alcohol which dissolves the plastic on the surface of the ruler. This plastic sticks to the paper and when pulled, gives out long threads. The solvent in which it was dissolved evaporates away leaving behind the thread like structure. A number of threads together side by side form a cloth-like sheet.

Cloth Processing...

You need: Strong alkali like NaOH, detergent to remove naturally present substances in the cotton that are responsible for its poor wetting ability.
What you do: In the *scouring* (= to clean a surface by friction) process, the cloth is dipped in the water. Strong alkali solution and detergent powder is added to the water. The fabric piece is boiled in water for about 4 hours or steamed in a pressure cooker for 30 minutes. Remove the fabric from caustic solution and wash in hot water of about 60 degrees. This is called hot wash. It is done to remove the caustic and other chemicals and impurities from the cloth.
What happens: The grey cloth becomes free of any impurities and staining agents after treatment. The caustic (NaOH) makes the oil impurities water soluble. Thus they are removed in the washing process giving the cloth good wetting ability (ability to hold water) required for dying process. It is now ready for dyeing or printing process.

Bleaching:
You need: Sodium hypochlorite or calcium hypochlorite (bleaching powder), or hydrogen peroxide, sodium silicate, sodium carbonate, detergent.
What to do: Bleaching of the scoured fabric can be carried out in presence of sodium hypochlorite or calcium hypochlorite (bleaching powder) at room temperature for half an hour.
Dip the cloth in water. Add sodium hypochlorite or calcium hypochlorite (bleaching powder) to it and let it stand for half an hour.
or
Boil the scoured cloth in a solution containing hydrogen peroxide, sodium carbonate, sodium silicate and detergent for 30 minutes followed by cold wash.
Wash the cloth in cold water.

What happens: The cotton cloth looks bright white.

Chemistry Around...

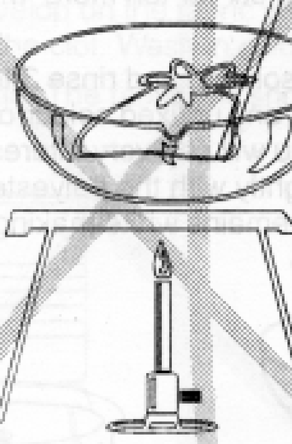
The insoluble impurities in the cloth are removed by action of soap and caustic and colouring matters present on the cloth are removed by bleaching. This cloth is now ready for printing.

Cloth Mordenting...

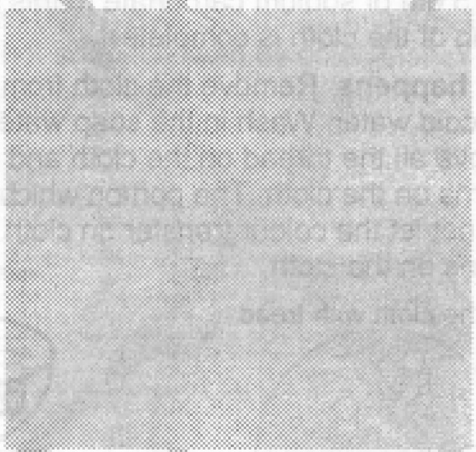
You need: Alum, cotton cloth for dying, water, vessel.

What to do: Dissolve alum powder in water and add it to the vessel containing required volume of water. Dip the wetted cotton fabric and start heating the vessel. Heat water to boil and maintain the temperature for 15 minutes with constant stirring. Remove the fabric from water and squeeze (do not wash).

What happens: The fabric gets a coat of alum. It is now ready for dyeing with a natural dye.



Boil the cloth with alum



Layer of mordent on the cloth

Chemistry Around...

Natural dyes do not have affinity (attraction) for cotton fabric. The above process of *mordenting* (or, mordanting = to subject to the action of, or imbue with, a mordant; as, to mordant goods for dyeing) gives a coat of alum/mordent which holds the cotton fabric and natural dye together due to its ionic bonding towards both.

Tie and Dye Patterns...

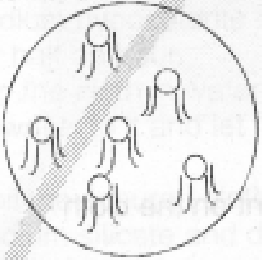
You need: Scoured (to scour = to clean a surface by friction) cotton cloth, polyester thread, reactive colour, sodium carbonate, sodium chloride, water and detergent.

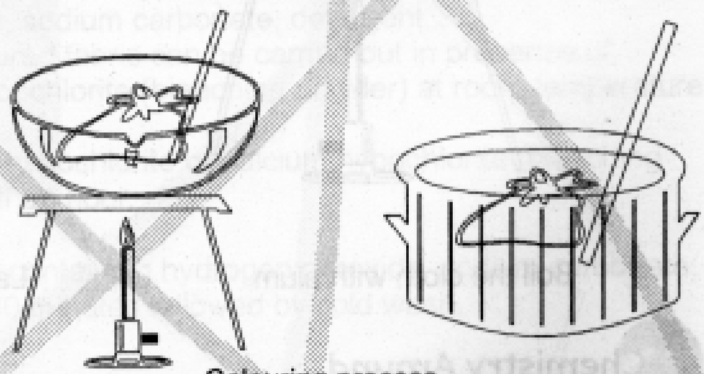
What to do: Make a desired design on the cloth with a pencil. Place a marble on the cloth and tie the polyester thread around it in 10 turns. Similarly tie the thread in multiple turns on the other design areas. Now the cloth is ready to be dyed.

Take two litres of water in a bucket. Add one spoonful of M brand reactive dye (see below) in the water. Stir constantly. Now add 200 gm of table salt to the same colour solution. Dip the tied cloth in the colour solution immediately. Keep stirring the cloth in the colour for fifteen minutes. You can see the dye getting transferred on the cloth. Add 15 gm of sodium carbonate to this solution and stir for ten more minutes. Dyeing of the cloth is complete.

What happens: Remove the cloth from the colour solution and rinse 3 to 4 times in plain cold water. Wash in the soap water to remove any unfixed colour on the cloth. Remove all the thread on the cloth and let it dry. You will see very interesting patterns on the cloth. The portion which was tied tightly with the polyester thread does not let the colour transfer on cloth. This area remains white making interesting designs on the cloth.

Tie the cloth with tread





Colouring process

Chemistry Around...

M brand is a category of reactive dyes which colours the cloth at room temperature. The reactive dyes can only colour a cotton yarn. Wherever the cotton fabric is covered with polyester yarn, it stops the colour from entering the fabric.

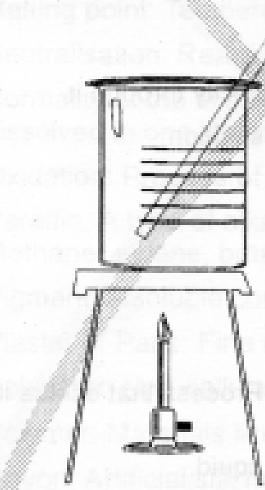
Sodium carbonate is used as a fixer which stops the colour from dissolving in water again. Salt is the medium in which colour is transferred on the cloth.

Surprize Colour on Cloth...

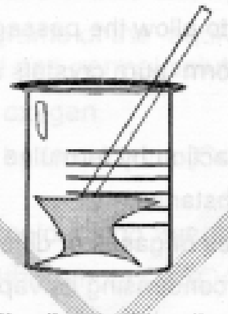
You need: Naphthol (e.g., beta naphthol), base (aromatic amine, e.g., aniline), HCl, sodium nitrite, NaOH, sodium acetate, cotton cloth, beaker, stirrer, gas, ice.

What to do: Take half teaspoon of naphthol powder and make a paste of it with warm water. Add caustic (sodium hydroxide)till you get a clear solution. Dilute it to the required volume. Put wet cotton cloth in the above solution for about 15 minutes with occasional stirring. In the second beaker take small amount of aromatic amine and paste it with water. Add HCl, ice and sodium nitrite and stir for some time. The aromatic amine will get diazotised (will be ready to form azo bond with naphthol). After 10 minutes add sodium acetate to remove (neutralise) HCl (hydrochloric acid). Take out the cotton cloth, squeeze the excess napthol solution and then put the cotton cloth in the second beaker with diazotised aromatic amine. Immediately bright colour will develop on the fabric which is an azo (N=N) dye. Stir for 10 minutes and then remove the clot. Wash in cold water and hot soap followed by cold wash.

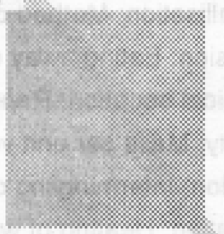
What happens: The fabric will show a bright colour..



Naphthol and Sodium hydroxide



Cloth dipped in diazotized aromatic amine



Bright colour appears on the cloth

Chemistry Around...

An azo dye (the dye has N=N bond) is formed on the fabric between naphthol and the diazotised aromatic amine which is bright in colour.

Glossary

Acid: Substance that yields hydrogen (H+) ions in solution.

Acidity of a base: Number of replaceable hydroxide ions in one molecule of base.

Anode: In a cathode ray tube, the positive electrode.
Electrode at which oxidation occurs. Electrode connected to the positive end of the battery during electrolysis.

Base: Substance that yields hydroxide (OH aq) in a solution.

Basicity of an acid: Number of replaceable hydrogen atoms in a molecule of base.

Boiling Point: Fixed temperature at which liquid changes its state into vapor. Also the condensation point.

Caustic: Name of the one of the strongest alkali, sodium hydroxide (NaOH), used widely in the industry.
Chemistry: Scientific study of the composition and properties of substances. What chemists do.

Catalyst: Chemical substance that affects the speed of the reaction without showing any changes in its own composition. Or being consumed in anyway.

Chromatography: Technique of separating different constituents from mixture of liquids (and gases too).

Condensation: Change of state from gas to liquid.

Conductivity: Property of a substance to allow the passage of heat or electricity through it.

Crystallisation: Method or process to form pure crystals of a solid from a solution.

Corrosion: Eating away of metals.

Chemical equation: Representing a reaction by formulae and symbols.

Density: Mass per unit volume of a substance.

Diffusion: Intermingling of the molecules of gases or different liquids.

Distillation: Heating of water and then condensing its vapor.

Electrolysis: Breaking up of a compound by passing electricity through it. Process that occurs in electrolytic cells.

Emulsion: Mixture of immiscible liquids which are kept in suspension in a liquid.

Evaporation: Change of state from liquid to vapor at any temperature other than its boiling point.

Endothermic reaction: Chemical reaction in which heat is absorbed.

Exothermic reaction: Chemical reaction in which heat is produced.

Electroplating: Coating metal objects with least reactive metals to prevent rusting.

Filtrate: Clear liquid obtained after passing solution through a filter paper.

Hard water: Water containing dissolved salts of calcium and magnesium because of which it does not form lather with soap.

Glossary

Hydrated salts: Many salts exist as small particles called crystals. Such salts have water molecule as part of their crystal structures and are called hydrated molecules. The water molecule present in the salt crystals is called water of crystallisation.
For example, copper sulphate has five molecules of water attached to its crystal form. The formula of hydrated copper sulphate is, $CuSO_4 . 5H_2O$

Humidity: Amount of water present in air.

Hydrocarbon: Compound of hydrogen and carbon.

Ionic bond: Bond between ions of opposite charges.

Inflammability: Property of substance to catch fire easily.

Lava: Hot liquid rock that comes out of volcano.

Litmus: Dye which is used as an indicator of acids and bases.

Mordant: Chemical which has affinity of cotton and dye.

Melting point: Temperature at which the solid changes to liquid.

Neutralisation: Reaction of hydrogen ions of acid and hydroxyl ions of base to form water.

Normality of the solution: Number of grams of the equivalent weight of a substance dissolved in one liter of water is called one normal solution.

Oxidation: Process of combining with oxygen.

Paraffin: A type of alkane (A group of hydrocarbons (C_nH_{2n+2}) with similar properties e.g. Methane, ethane, butane etc.)

Pigment: Insoluble compound used a colourising agent.

Plaster of Paris: Fine white powder with formula $CaSO_4.1/2H_2O$.

Polyester: Non-cellulose fibers made from petroleum products.

Polymer: Materials like plastic having long chain molecules.

Rayon: Artificial silk made from cellulose.

Reduction: Process of combining with hydrogen.

Redox reaction: Chemical reaction in which both oxidation and reduction take place.

Solvent: Molecules of liquid in a solution.

Sublimation: Change of state of matter from solid to gas with out passing through liquid state.

Suspension: Unclear solution because of the presence of insoluble lighter substances which do not sink to the bottom and remain suspended.

Soap: Cleansing agent made by reacting sodium hydroxide with fats.

Laboratory Discipline...

Some Do's and Don'ts

Do the experiments carefully. Do not take any chemicals on your hand directly. Always use the spoon or a paper slip to lift or transfer chemicals. Always use dropper or spoon to add/transfer liquids. All those experiments in which fumes are likely to come out, perform them outdoors or keep the windows of the room open.

Preferably perform all the experiments in which acids or other chemicals are involved in the presence of an elder. Do not use aluminum or metal vessel for preparing soap. Use plastic buckets.

In other experiments, you can use old glass storage jars, injection bottles, glass bowls etc. After washing and drying them thoroughly. Make sure to use a fresh jar or bottle to pour new chemical. Do not mix unknown chemicals by yourself. Do not throw them in the dustbin. Always put them in a separate polythene bag along with some sand.

Most importantly, never ever taste any of the chemicals from your experiments. Even if you take things from the kitchen or fruits or food, do not eat it after using in the experiment.

These are some safety measures to be carried out in a chemistry laboratory. You also observe them in your own home laboratory so you can learn and enjoy your experimental work. Your own safety stands first.

Chemistry Around...

How to dilute an acid: In the laboratory, we come across two types of acids, concentrated and dilute. Dilute acids are the once mostly used in the laboratory for various reactions. For diluting the acid, acid should be poured slowly in water.

Aqua Regia: Concentrated hydrochloric acid is used to make aqua regia. Aqua regia is a 1:3 mixture of concentrated nitric acid (one part) and hydrochloric acid (3 parts). It is used to dissolve precious metals like gold and platinum. It is also known as royal water.

First Aid...

- For all types of burns --acid, alkali, hot metal -- the same first aid is required: pour the coolest and cleanest water available. Soaking the burnt part for the first hour decreases pain. Water may form blisters but the fluid in the blisters actually helps heal the burn.
- If some acid falls on your skin, then immediately wash the burns with strong stream of cold water for 3 to 5 minutes. Afterwards apply cotton wool dipped in 3% potassium permagnate solution. (Put approx. 3 gm potassium permanganate ($KMnO_4$) in 100 ml. of water.) Do not put any burns ointment -- they have no use. If the burns are severe, see a physician.
- If your skin has been burnt by an alkali solution (NaOH or KOH) wash the burnt spot with water till the skin stops feeling slippery. Wash for 15 minutes. Then apply bandage dipped in 3% potassium per manganate ($KMnO_4$) solution.
- If you have burnt your skin with a hot object (glass, metal etc.), wash copiously with cold water. Apply cotton wool dipped in 3% potassium per manganate ($KMnO_4$) solution and apply ointment for burns.
- If you or your friend inhale some fumes or gases, or some chemical gets into your eyes, see the doctor immediately.
- Work in chemical laboratory is interesting and effective, provided the experimenter is careful, disciplined and attentive.

Chemistry Around...

Laboratory notebook

Write your name, name of the school, class and your address on the first page.

For writing the experiment observations;

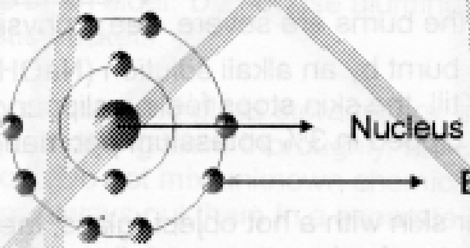
1. The date of performing the work.
2. The names and topic of the experiment.
3. A description of the conditions of experiment.
4. A drawing or diagram of the apparatus used.
5. All observations including the change in colour , separation or the nature of the precipitate.
6. Answers to all the questions asked in the experiment book.
7. Relevant chemical equations for the experiment.

Atoms and Molecules

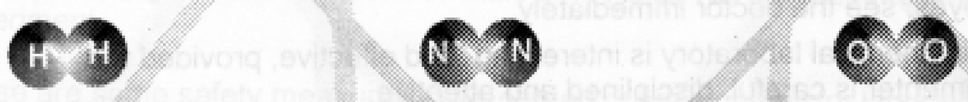
All matter is made up of small particles called atoms.

An atom is very small. The mass of the hydrogen atom is of the order of 10^{-27} kilogram, that is one divided by 1 followed by 27 zeroes.

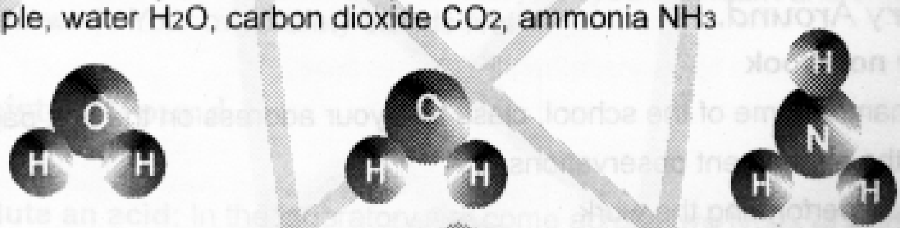
The central portion of an atom is called the nucleus. Inside the nucleus there are protons and neutrons. And many other particles. Electrons revolve round the nucleus in orbits or shells.



Some elements can not exist as individual atoms. They are made up of similar atoms bonded together to form molecules. For example, oxygen O_2, nitrogen N_2, hydrogen H_2



A molecule of a compound is made up of two or more atoms of different elements. For example, water H_2O, carbon dioxide CO_2, ammonia NH_3



Chemistry Around...

Atoms taking part in a chemical reaction are only rearranged in a chemical reaction. They are neither created nor destroyed.

Only molecular forms are written in a chemical reaction since atomic forms are not stable. For example: If chlorine and hydrogen are involved in a chemical reaction, they are written as Cl_2 and H_2.

Valency and Chemical Symbols...

First 20 elements

Element	Symbol	Electrons in orbits	Valency
Hydrogen	H	1	-1
Helium	He	2,	0
Lithium	Li	2,1	-2
Beryllium	Be	2,2	2
Boron	B	2,3	3
Carbon	C	2,4	-2
Nitrogen	N	2,5	-3
Oxygen	O	2,6	-2
Fluorine	F	2,7	-1
Neon	Ne	2,8	0
Sodium	Na	2,8,1	1
Magnesium	Mg	2,8,2	2
Aluminum	Al	2,8,3	-3, 6
Silicon	Si	2,8,4	-2, -4
Phosphorus	P	2,8,5	-3, 5
Sulphur	S	2,8,6	-2
Chlorine	Cl	2,8,7	-1
Argon	Ar	2,8,8	0
Potassium	K	2,8,8,1	1
Calcium	K	2,8,8,2	2

Some electrons have their last orbits full, hence stable. They are reluctant to react with other molecules. They are called inert gases.

Chemical Formula...

A molecule of an element or compound consists of different atoms. It is represented by number of atoms of each element present in the molecule. These atoms are known by certain chemical symbols based on their names with origins in either Greek, Latin or English language. That is why such molecular formula is also called chemical formula.
The chemical formula of an element shows number of atoms present in one molecule of an element. Chemical formula of a compound shows number of atoms of different elements present in one molecule.

Writing chemical formula:
1. Write the symbol of the constituent elements present in the compound, e.g., Na Cl.
2. Write the valency of the each element as superscript at the right side top corner.
3. While writing the formula, exchange the valencies of opposite elements or radicals. Write is as subscript and write the formula. In any formula, the metallic portion of the compound is written first followed by the non-metallic portion.

H^1 Cl^1	Hydrochloric acid	H_1Cl_1 = HCl
Ca^2 CO_3^2	Calcium carbonate	Ca_2CO3_2 = CaCO3
Na^1 CO_3^2	Sodium carbonate	$Na_2(CO_3)_1$ = Na_2CO_3
Fe^2 Cl^2	Ferrous chloride	Fe_1Cl_2 = $FeCl_2$

Chemistry Around...

Some compounds and their chemical formula:

Hydrochloric acid	Hcl	Sodium chloride	NaCl
Potassium hydroxide	KOH	Calcium carbonate	CaCO3
Copper sulphate	CuSO4	Sugar	C12H22O11
Magnesium oxide	MgO	Ammonia	NH3
Aluminum iodide	AlI3	Sodium carbonate	Na2CO3
Potassium Permanganate	KMnO4	Ferric chloride	FeCl3

Acids...

The term acid comes from a a Latin word 'aciduous' meaning sour. Some acids are found freely in nature such as lemon, grapes etc. Some acids are prepared from the minerals present in the earth's crust. For example, sulphuric acid (H_2SO_4), nitric acid (HNO_3).

Some naturally occurring acids

Natural source	Acid present
Grapes, oranges, lemons	Citric acid
Apples	Malic acid
Tomatoes	Oxalic acid
Tamarind, blue berries	Tartaric acid
Sour milk	Lactic acid
Vinegar	Acetic acid
Proteins	Amino acid

Common indicators

Indicator	Colour in acid
Litmus	Red
Methyl orange	Orange
Phenolphthalein	Colourless
Red cabbage juice	Red

Chemistry Around...

Nitric acid is used to make fertilisers like ammonium nitrate, calcium ammonium nitrate etc.

Sulphuric acid is used in manufacturing of paints, dyes, and car batteries.

Hydrochloric acid is used in purification of common salt. It is also used as cleansing agent in the process of galvanisation.

Bases...

Bases are oxides or hydroxides of metals. Bases that dissolve in water are called alkalies. All bases are alkalies but all alkalies are not bases. Bases are prepared by combination of metal with oxygen or by dissolving basic oxides in water. Bases have a bitter taste and are soapy to touch.

Common bases and alkalies

Name of the base	Formula
Zinc oxide	ZnO
Magnesium oxide	MgO
Copper oxide	CuO
Sodium hydroxide	$NaOH$
Potassium hydroxide	KOH
Ammonium hydroxide	NH_4OH
Calcium hydroxide	$Ca(OH)_2$

Common indicators

Indicator	Colour in base
Litmus	Blue
Methyl orange	Yellow
Phenolphthalein	Pink
Red cabbage juice	Blue

Chemistry Around...

Bases are used as antacids.

Sodium hydroxide is used in making soaps, detergents, paper pulp and rayons.

Bases are used as indicators in chemical laboratories.

Calcium hydroxide is used in making plaster, mortar and bleaching powder.

Salts...

A salt is formed by a neutralisation reaction between acid and base. In such reaction, hydrogen of an acid is replaced by the metal of the base to form a salt. All salts are made of an acid and a basic radical. All salts are neutral in nature.

Neutralisation reactions

$$\underbrace{\text{Base} + \text{Acid} \longrightarrow \text{Salt} + \text{Water}}_{\text{Neutralisation}}$$

1. Calcium hydroxide + Sulphuric acid $\longrightarrow$ Calcium sulphate + Water

$$Ca(OH)_2 + H_2SO_4 \longrightarrow CaSO_4 + 2H_2O$$

2. Copper hydroxide + Nitric acid $\longrightarrow$ Copper nitrate + Water

$$2Cu(OH)_2 + 2HNO_3 \longrightarrow 2Cu(NO_3)_2 + 2H_2O$$

3. Sodium hydroxide + Hydrochloric acid $\longrightarrow$ Sodium chloride + Water

$$NaOH + HCl \longrightarrow NaCl + H_2O$$

Chemistry Around...

Salts made from sulphuric acid are called sulphates, e.g., calcium sulphate ($CaSO_4$).

Salts made from nitric acid are called nitrates, e.g., calcium nitrate ($Ca(NO_3)_2$).

Salts made from hydrochloric acid are called chlorides, e.g., calcium chloride ($CaCl_2$). Salts made from phosphoric acid are called phosphates, e.g., calcium phosphate ($Ca_3(PO_4)_2$)..

Salts made from carbonic acid are called carbonates, e.g., calcium carbonate($CaCO_3$.)

Bases are used as antacids (anti-acids). Sodium hydroxide is used in making soaps, detergents, paper pulp and rayons. Bases are also used as indicators in chemical laboratories. Calcium hydroxide is used in making plaster, mortar and bleaching powder.

The Periodic Table...

"If, in some cataclysm, all of scientific knowledge were to be destroyed and only one sentence passed on to the next generation of creatures, what statement would contain the most information in the fewest words? I believe it is the atomic hypothesis...that all things are made of atoms...In that one sentence...there is an enormous amount of information about the world, if just a little imagination and thinking are applied."

---Richard Feynman

In 1869, Mendeleev (1834-1907) was among the first to try and organise elements in some order --- called a periodic table. Elements are arranged in order of increasing atomic numbers in the periodic table.

The vertical columns in the table are called groups. All the elements in the group behave similarly in a chemical reaction.
Most metals have only one electron in their last orbit and are highly reactive. They are ready to donate the electron. Most naturally occurring elements are metals.
Most non-metals have in complete orbits so they are ready to accept electrons.
The elements in the last group have complete orbits, therefore they do not react. They are called Inert Gases.
Some elements have changing valencies. They are called transition metals.
Some elements show poor metal-like properties. They are called metalloids.
Elements beyond atomic number 92 (Uranium) are not naturally occurring and are made in the lab.

Some useful definitions --
Atomic Number: Number of protons in the nucleus of the atom.
Atomic mass: Number of protons and neutrons in the nucleus of the atom.

Activity:

Colour the metals, non metals, transition metals, metalloids and noble gases in different colours in the neighboring periodic table. The dark lines separate them.

☐ Metals are highly reactive

☐ Non-Metals are ready to accept electrons

☐ Metalloids have some properties of metals and some of non-metals.

☐ Noble gases

The Periodic Table

H Symbol
1 At.mass
1 At. Number

Metals

Non-Metals

Transition Metals

Borons and Carbons

Nitrogens and Oxygens

Halogens

Alkali Metals 1	2 Alkali earth metals											3	4	5	6	7	Inert gases 8
H 1 1 Hydrogen																	He 4 2 Helium
Li 7 3 Lithium	Be 9 4 Berelium											B 11 5 Boron	C 12 6 Carbon	N 14 7 Nitrogen	O 16 8 Oxygen	F 19 9 Fluorine	Ne 20 10 Neon
Na 23 11 Sodium	Mg 24 12 Magnesium											Al 27 13 Aluminum	Si 28 14 Silicon	P 31 15 Phosphorus	S 32 16 Sulphur	Cl 35 17 Chlorine	Ar 40 18 Argon
K 39 19 Potassium	Ca 40 20 Calcium	Sc 45 21 Scandium	Ti 48 22 Titanium	V 51 23 Vandanium	Cr 52 24 Chromium	Mn 55 25 Manganese	Fe 56 26 Ironn	Co 59 27 Cobalt	Ni 59 28 Nickel	Cu 64 29 Copper	Zn 65 30 Zinc	Ga 70 31 Gallium	Ge 73 32 Germanium	As 35 33 Arsenic	Se 79 34 Selenium	Br 80 35 Bromine	Kr 84 36 Krypton
Rb 85 37 Rubidium	Sr 88 38 Strauncium	Y 89 39 Yttrium	Zr 91 40 Zirconium	Nb 93 41 Niobium	Mo 96 42 Molybdenum	Tc 97 43 Technetium	Ru 101 44 Ruthenium	Rh 103 45 Rhodium	Pd 106 46 Palladium	Ag 108 47 Silver	Cd 112 48 Cadmium	In 115 49 Indium	Sn 119 50 Tin	Sb 122 51 Antimony	Te 128 52 Tellurium	I 127 53 Iodine	Xe 131 54 Xenon
Cs 133 55 Cesium	Ba 137 56 Barium	La 139 57 Lanthanum	Hf 178 72 Hafnium	Ta 181 73 Tantalum	W 184 74 Tungstun	Re 186 75 Rhenium	Os 190 76 Osmium	Ir 192 77 Iridium	Pt 195 78 Platinum	Au 197 79 Gold	Hg 201 80 Mercury	Tl 204 81 Thallium	Pb 207 82 Lead	Bi 209 83 Bismuth	Po 209 84 Polonium	At 210 85 Astatine	Rn 222 86 Radon
Fr 223 87 Francium	Ra 226 88 Radium	Ac 227 89 Actinium	Rf 260 104 Rutherfordium	Db 105 Dubnemium													

Ce 58 Cerium	Pr 59 Praseodymium	Nd 60 Neodymium	Pm 61 Promethium	Sm 62 Samarium	Eu 63 Europium	Gd 64 Gadolinium	Tb 65 Terbium	Dy 66 Dysprosium	Ho 67 Holmium	Er 68 Erbium	Tm 69 Thulium	Yb 70 Ytterbium	Lu 71 Lutetium
Th 90 Thorium	Pa 91 Protactinium	U 92 Uranium	Np 93 Neptunium	Pu 94 Plutonium	Am 95 Americium	Cm 96 Curium	Bk 97 Berkelium	Cf 98 Californium	Es 99 Einsteinium	Fm 100 Fermium	Md 101 Mendelevium	No 102 Nobelium	Lr 103 Lawrencium

Shishu Milap, Vadodara, Gujarat, is a voluntary organisation working for improving access to education and living amenities to poor children.

Shishu Milap coordinates creative science learning programmes in government schools of Vadodara district. This programme emphasises on learning science by exploration and discovery. Children get first hand experience of performing science experiments in the classroom situation.

Activity-based science curricula have been developed for this programme in the form of workbooks and material kits for classes 5, 6 and 7. The workbooks are titled "Shodh-khol" meaning exploration.

This book is aimed at helping children develop a love for chemistry and its experiments. It offers a number of activities with descriptions and illustrations. They are designed to help students understand the importance of experimental work in chemistry. Experimental material is available with Shishu Milap in the form of kits.

Price: Rs 50/- only